MEMORANDUM REPORT ARBRL-MR-03259

A PROCEDURE FOR THE SEMIAUTOMATIC REDUCTION OF EXPERIMENTAL DATA DIGITIZED FROM ANALOG TAPE

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A procedure has been devised to process the experimental data which are recorded on wide-band, frequency-modulated tape recorders at the Interior Ballistics Division of the Ballistic Research Laboratory. The data are digitized using a minicomputer, transported to a mainframe, and then processed on the mainframe. Four FORTRAN IV programs have been written to do this processing. Separate programs are necessary because judgments must be made after each step before proceeding with the next.

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TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

I. INTRODUCTION

Studies of the interior ballistics of guns and rockets and the dynamics of weapon systems require the recording and analysis of large amounts of time-correlated information. The type of information associated with ballistic phenomena usually has a high frequency content and a short duration. Wide-band, frequency-modulated (FM) magnetic tape recorders are used to record this type of data. These recorders have the capability of recording simultaneously fourteen channels of 80 kilohertz (kHz) data at their maximum recording speed. A problem arises with this type of recording when an automated data reduction system is used. The problem is that automated data reduction methods invariably use a digital computer which requires that the information be in binary format. The obvious solution is to sample the original FM tape at an appropriate rate and to convert the information from analog form to digital form (A/D) which can then be recorded on a digital tape.

Since the digitizing equipment used in the Interior Ballistics Division (IBD) of the Ballistic Research Laboratory (BRL) either was not computer-controlled or has severe main memory limitations, the IBD recently purchased a Hewlett-Packard (HP) minicomputer, Model 1000-F, with which to digitize firing data, off-line, from analog tapes. The biggest advantage to this system is that the available main memory does not limit the amount of data which can be digitized in one pass; this is accomplished using a double buffering technique which effectively allows the transfer of data from tape directly to disc. The capacity of the disc now becomes the limiting factor of the amount of data digitized. Reports on the actual A/D equipment and the associated software will be published soon.

The data, once digitized and stored on the disc, can then be transported to the mainframe. At BRL, this is a CDC CYBER System: 1) mainframe A (MFA), a CYBER 170/173, and 2) mainframe Z (MFZ), a CYBER 70/76. A CalComp plotter, Model 1055, is a peripheral to that system.

A procedure is described in this report for the step-by-step processing of these data until they are converted into engineering units and then stored on a permanent file, integrated, tabulated, and/or plotted. The computer programs involved are given as well as sample inputs and outputs.

II. CONVERSION OF DATA ON ANALOG TAPE TO DIGITAL TAPE

An oscillograph record of a single channel of interior ballistic data is shown in Figure 1. It is an analog pressure-time record, with calibrations, reproduced from one channel of a 14-channel magnetic tape. To convert this record to digital form, an A/D converter samples the analog signal at a selected time and at an appropriate rate. It is important that the sampling times and rates preserve the original pressure-time relationship; i.e., the sampling times must be directly related to the real time of the event.

The sampling rate for the calibration steps is somewhat arbitrary. The only basic requirement is to get enough samples to make a reasonable evaluation of the level by averaging. The sampling rates for the record portion must next be determined. In this case, the sampling rate is more critical. If the rate is too low, there will be insufficient information to reconstruct the continuous record. For example, in Figure 1, if a 5 kHz

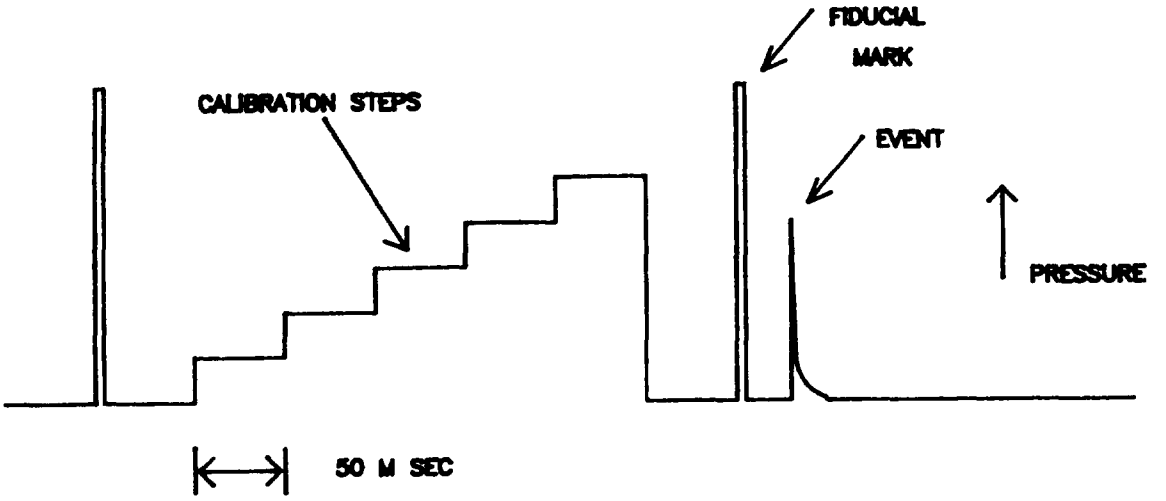


Figure 1. Analog Pressure-Time Record

sampling rate is used for the pressure-time portion, it would be impossible to make an accurate peak pressure measurement from the few samples obtained. Conversely, if the sampling rate is higher than that necessary to reconstruct the signal, expensive computer time will be wasted processing unnecessary data. It is obvious that a million samples would not necessarily produce a better defined record, indicating that there is a direct relation between the rate that the data vary and the number of the samples needed to accurately reconstruct it. The rate that a signal varies is directly related to its maximum frequency content or bandwidth. The commonly used sampling rate is five times the maximum data frequency content or bandwidth of the signal.

The bandwidth of an FM tape recorder is directly proportional to the tape speed. The actual bandwidth versus speed varies with the recorder; for instance, using FM Wide Band I at 120 inches per second (ips) the FM bandwidth is 80 kHz, at 60 ips the bandwidth is 40 kHz, etc. A proper sampling rate can therefore be selected based on the tape speed. For example, to record information with a frequency content of 40 kHz, the tape speed would be set at 60 ips which would indicate a 200k samples per second rate that is five times the bandwidth.

For data channels with calibration steps, one has a choice of two digitizing procedures. Normally the calibration duration is approximately 300 milliseconds, while the event lasts only ten or twenty milliseconds. The first choice is to make two passes over the data: one at a low digitizing rate for calibration steps and one at a high rate for the event. Often this method leads to bookkeeping uncertainties in matching calibration steps to the event. The second, and more preferred, choice is to digitize both calibration steps and the event at the higher digitizing rate and to eliminate the uncertainty, even though many more data are generated. The excess data can then be eliminated at a later time as discussed in Step 3.

The HP digitizer has the capability to digitize up to 16 channels of data in one pass of the analog tape. Consequently, the data that are stored on the disc are interwoven; that is, they are stored x_1, y_1,..., z_1, x_2, y_2,..., z_2,... These data need to be sorted and this is discussed in Step 2.

Next, the data on the disc file of the HP1000 must be transported to a disc file on the BRL mainframe where the data analysis programs reside. The data can be transported in two ways: 1) They can be transferred to a 9-track digital tape which is then hand-carried to the CYBER tape library. 2) They can be transmitted interactively from the disc through an HP9845 desktop computer/terminal to the CYBER MFA via a modem link. This process is discussed in Step 1.

Step 1. Creating a file on CYBER MFA or MFZ

Data can be transferred between the HP1000 and the CYBER using the modem link on the HP9845 or using magnetic tape. Each method is discussed below.

A. Modem link

1. We have chosen not to link the HP1000 directly to the CYBER. Instead, the connection to the CYBER is through an HP9845 using an emulator routine which makes the terminal look like a Tektronix 4014 to the CYBER.

2. An HP9845 is connected to the HP1000. Data can be transferred from the HP1000 to the HP9845 and then to the CYBER. The reverse transfer can also be made.

3. This method is slow and is not recommended for large data files.

4. Directions for using the HP9845 communications are given in Appendix A.

5. The disc file on the CYBER MFA contains data in the following format:

   Record 1 contains

DT	Time between samples
INW	Number of data words

   Records 2,3...contain

   INW data words

All data are in format (4E20.14). If INW is not a multiple of four, the remainder of the last record is filled with zeros.

B. Magnetic Tapes

1. At the present time, this method is still the most efficient and least time-consuming way to transfer large amounts of data to the CYBER. Interactive usage on MFA greatly increases the clock time for a job which uses tapes. It is faster and cheaper to read tapes on MFZ. The user has the option of reading his tapes on either MFA or MFZ.

2. Directions for using the procedures to read specific digital tape formats and an example are given in Appendix B.

3. The disc file created on the CYBER by the program which reads the HP tape contains data in the following format:

Record (buffer) 1 contains header information

ITYPE	Type of File (0: A/D file)
NAMEF	File name on the HP1000 tape
MSSG	Tape label
NCHAN	Number of channels
LRECL	Logical record length
NREC	Total number of records
IREC	Number of data records (NREC - 1)
SRATE	Sampling rate
IPBR	Tape speed factor
DT	Time between samples

Records (buffer) 2 through NREC contain the data.

This format is repeated for all the files on the HP1000 tape.

4. To read the disc file containing the data, you must use an unformatted READ for the data records for each file transferred.

The FORTRAN statements required are as follows:

```
10    READ(u)  ITYPE,NAMEF,MSSG,NCHAN,LRECL,NREC,IREC,SRATE,IPBR,DT
      IF(EOF(u).NE.0)   GOTO   100

      DO   20  J=1, IREC
           READ(u)  INW,   (IDATA(I),I=1,INW)
           .
           .
           .
20    CONTINUE
           .
           .
           .
      GOTO 10
           .
           .
           .
100   STOP
```

NOTE: 1) Since the current maximum logical record length in the programs which create these tapes is 8192 (16-bit words), the number of CDC 60-bit words required is 2185 per record (buffer). The actual limit in the CDC program to read the tapes is 3000.
2) At the moment, only A/D tapes (ITYPE=0) are converted. Other types of tapes will be developed later. If it becomes necessary to read these tapes on the CYBER, appropriate changes will have to be made in the conversion program. The program will print a warning if ITYPE ≠ 0, but it will not prevent execution.

3) u is the unit number you assign to read your disc file in your PROGRAM statement.
4) INW is the number of samples in each record.
5) Unformatted input/output transfers data between main memory and an external storage device. Data are not converted to any format when read or written this way. However, the user should be aware that the data, when written in a formatted WRITE, are actually INTEGER data.

Once the data have been transferred to a CYBER disc file, they must be sorted since, when the digitization is done, all channels of interest are sampled at one analog tape position before proceeding to the next position. This is Step 2.

Step 2. Sorting the data into contiguous sequences.

The data are obtained by sampling all channels from the analog tape to be digitized at a given position before moving on to the next position, as illustrated in Figure 2.

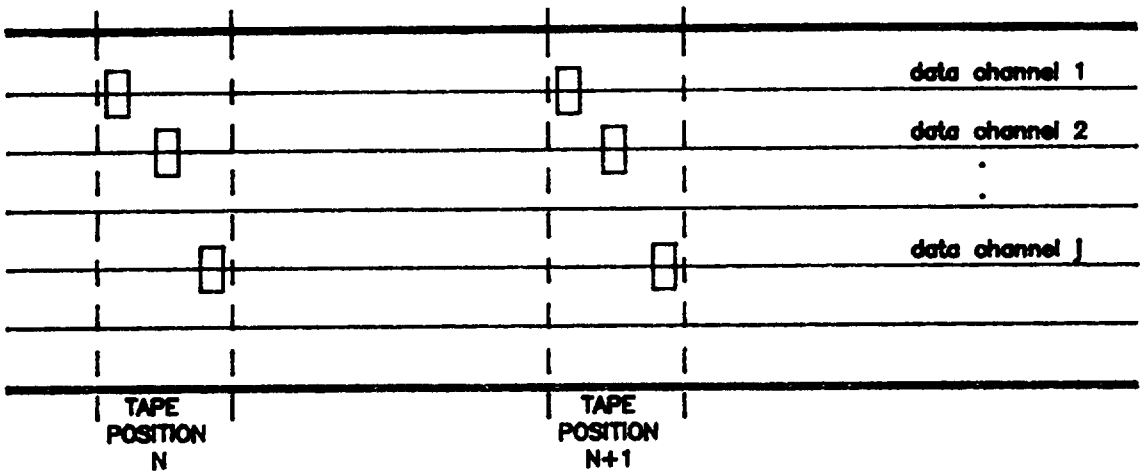
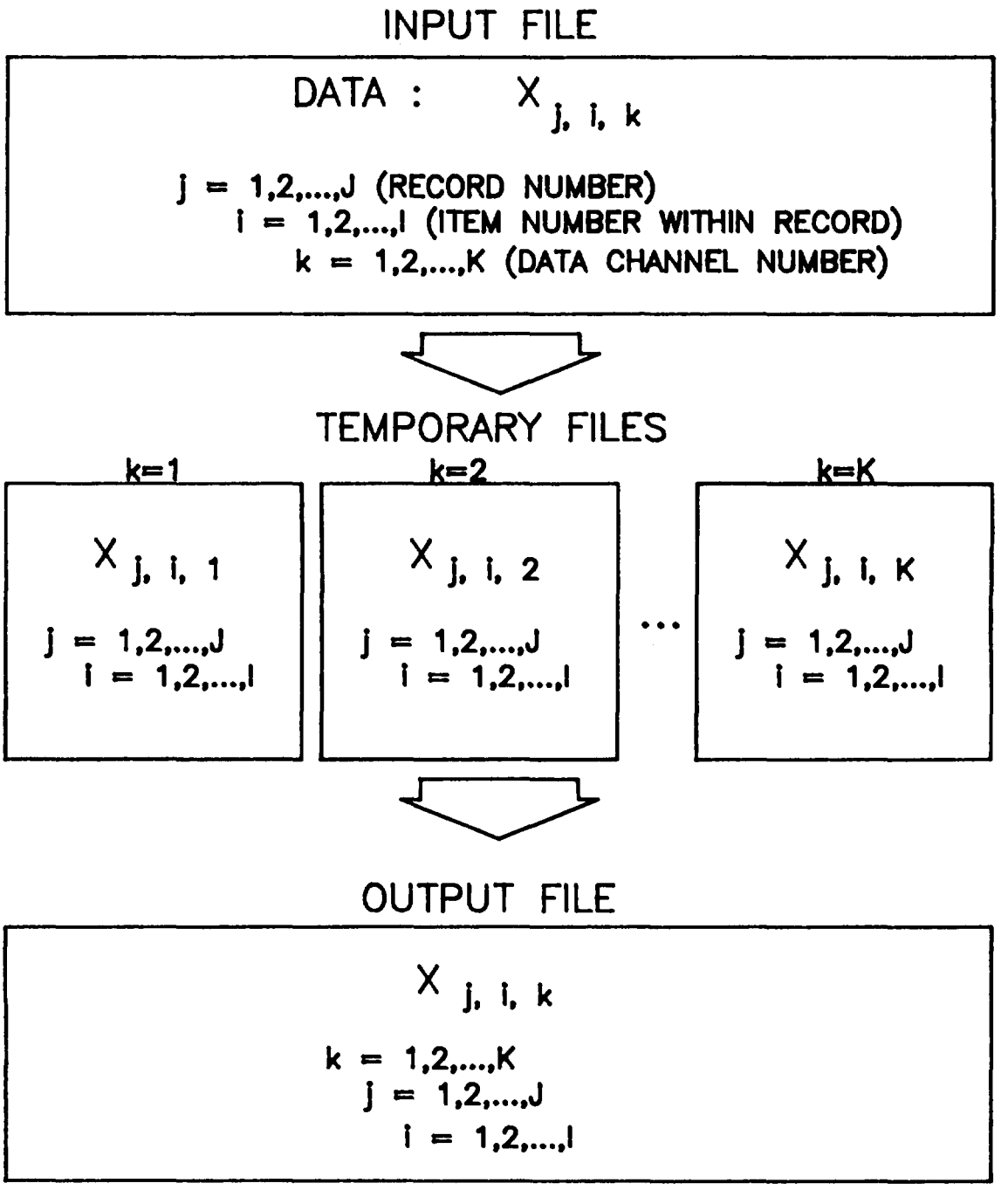


Figure 2. Data Sampling Format

Since the analog tape is actually moving at a constant speed, there is a slight time skew from channel to channel, but this skewness is normally negligible compared to the sampling rate.

A computer program has been written for MFZ to sort the data into contiguous sequences, plot the sequences, and write a permanent file for the next step. (See Appendix C.) Since all of the data for one channel are not in memory at any one time, several sequences are formed and stored on temporary files, one file for each channel, until the end of the digitizing pass. Each temporary file is then written, in order, to the permanent file in such a way that all of the sequences for the first channel are written first, all of the ones for the second channel are next, and so forth. This procedure is illustrated in Figure 3.



NOTE: Temporary files are necessary because the data are read one record at a time and the quantity of data may be very large.

Figure 3. Schematic of the Procedure To Sort the Data

In the example shown in Figure 4, the calibration steps and the event are digitized in the same pass. This method creates an excess of data points. An editing procedure to save only the pertinent data is discussed next in Step 3.

Step 3. Editing the Data File

A typical channel of data can be divided into seven sections, as shown in Figure 5. Not all channels contain every section. Sections 1, 3, 5, and 7 contain data which can be deleted; however, the duration of Section 5 must be accounted for if time is counted from the fiducial mark in Section 4 and is stored in the variable TSTART on the output file. Using this rationale on the example in Figure 4, sequences 1, 2, 13, 17, 18,...,23 can be deleted. Now, sequences 3 through 12 make up section 2; sequence 14 makes up section 4; and, sequences 15 and 16 make up section 6. There is no section 5 in this example. Next, we sample section 2 at equally spaced intervals. Thus, using this method, we have vastly reduced the number of data points.

A computer program has been written for MFZ to edit the data, plot the results, and write a permanent file to be used in Step 4, where the conversion to engineering units is done. The input parameters required for the program are: 1) the sequence numbers where sections 2 through 7 start, 2) the sampling interval for the calibration steps (for instance, if one sample is taken for every fifty input data points - the interval equals fifty), 3) the sampling interval for the event, and 4) the option to print a message. For the example in Figure 5, the input, format 9I5, would be:

```
3   13   14   15   15   17   50    1    0
```

Following this process, the data points for a given channel can finally be merged into one sequence. A computer listing of Step 3 is in Appendix D. A plot of the results thus far is shown in Figure 6.

Step 4. Converting to Engineering Units

A computer program[1] was written several years ago to convert digitized data into engineering units. The program was modified to accept the data produced in Step 3. The mechanics of handling the data are different, but the actual conversion is the same. The equipment producing the data and recording them on analog tape has not changed; just the digitizing equipment has changed. This FORTRAN IV program directs the digital computer to read the information from the computer file, perform the many necessary calculations, and provide the reduced data in tabular and/or plotted form as output of the computer. This program, which is in modular form, has many options which are chosen according to the particular input data and the desired output. The options available to date in the program are: (1) calibration, (2) location of a step function, (3) conversion of the dependent variable to engineering units, (4) integration of the dependent variable, (5) plotting of the output data, and (6) tabulation of the output data.

[1] *C.L. Henry, R.L. Martz, E.M. Wineholt, "An Improved Procedure For The Reduction of Interior Ballistic Data Recorded on Analog Tape," BRL MR 2374, April 1974 (AD 919924L).*

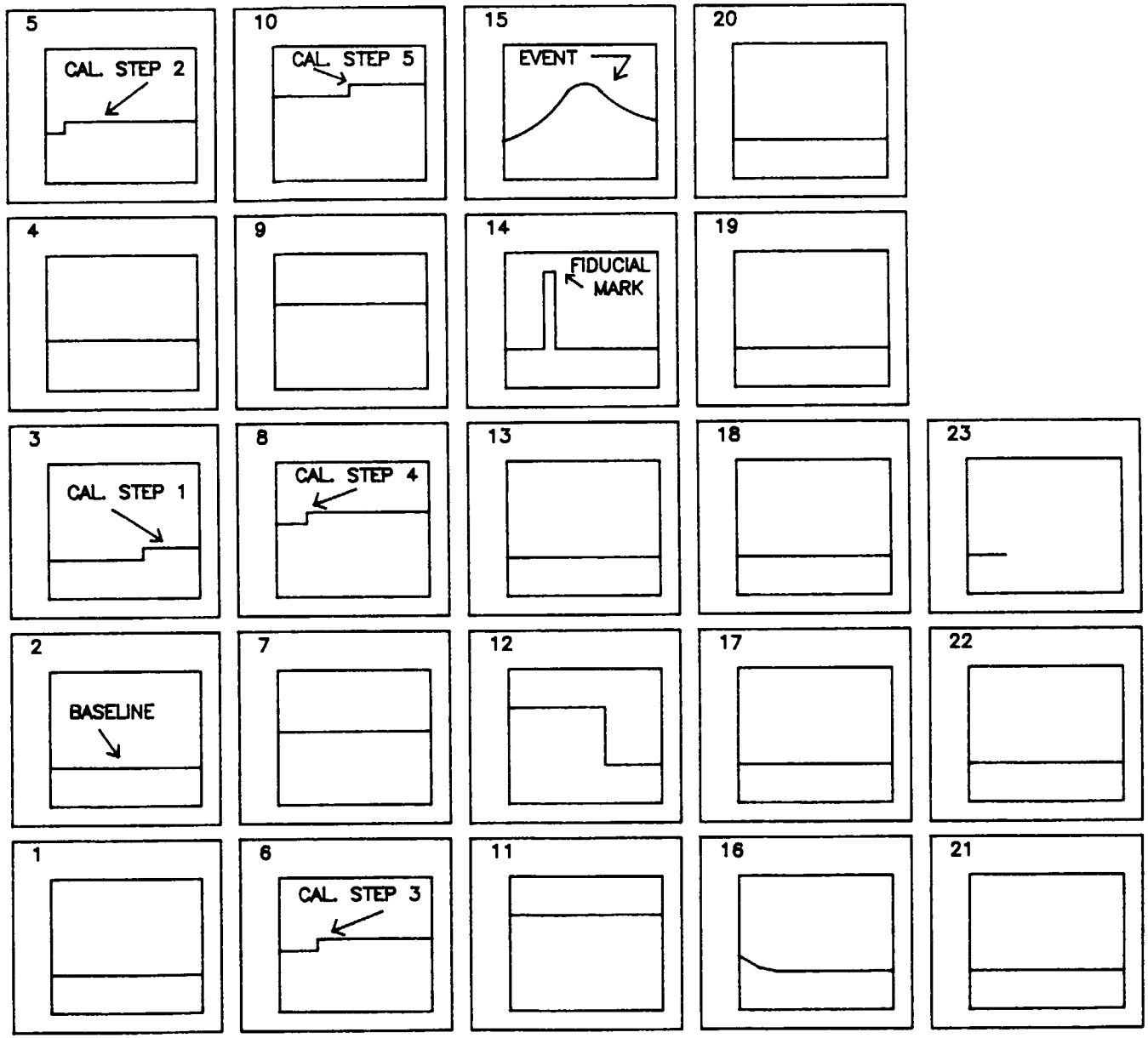


Figure 4. An Example Showing the Sequences of a Data Channel at the End of Step 2

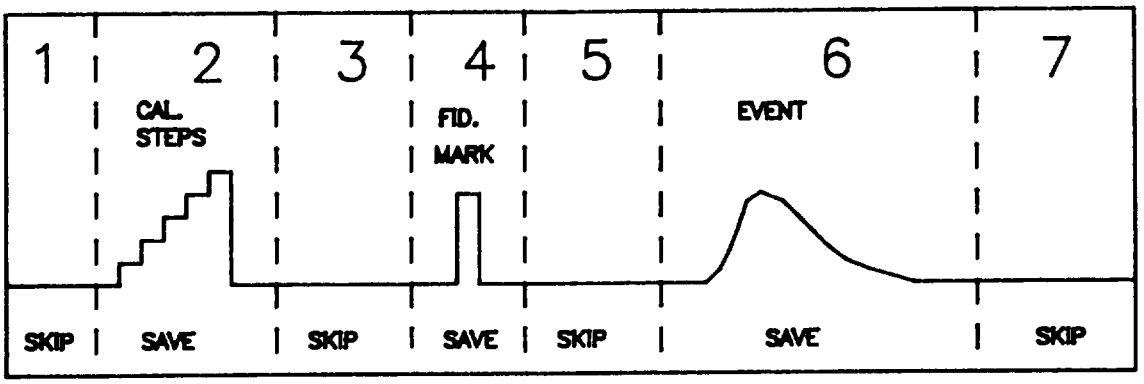


Figure 5. Typical Sections of a Data Channel

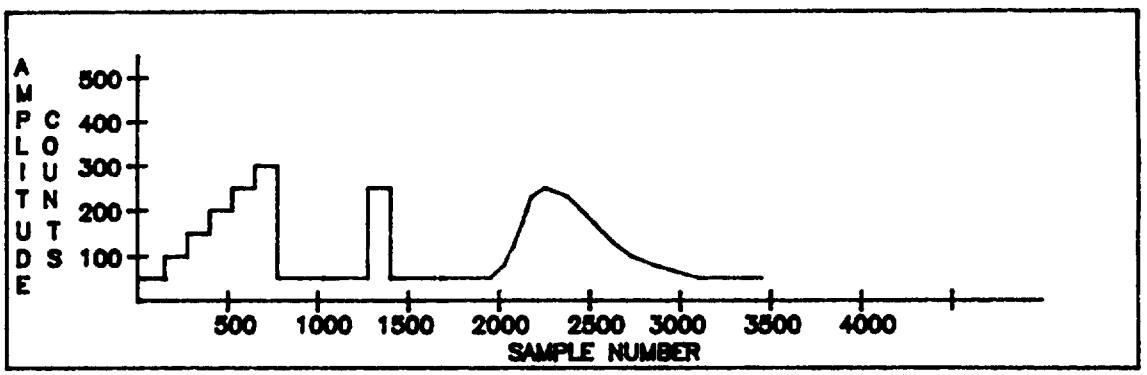


Figure 6. An Example of the Data Remaining After Editing

Basically, the conversion is accomplished by fitting a second-degree polynomial by the method of least squares to the amplitudes in counts of the calibration steps which have known values in engineering units. Thus, the relationship between engineering units and counts is determined and the conversion can be accomplished. The time for each data point relative to the fiducial mark is also calculated. The option to integrate once or twice is provided as well as the option to plot or not. A listing of the program and a sample input and output are in Appendix E.

Various parameters are necessary input data for the program, as illustrated in Figure 7. They are:

1.	NX	The number of samples to be averaged for each calibration step,
2.	NY(i),i=1,...,NS (NS ≤ 6)	The sample indices marking the position on each calibration step to start processing data,
3.	ITZ	The number of samples to skip after sampling the last calibration step before starting to search for the fiducial mark,
4.	IX	The number of samples to skip after the fiducial mark to reach the data which are to be converted to engineering units,
5.	IBSE	The number of samples to skip after the fiducial mark before starting to sample the baseline,
6.	B	The calibration constant for the gage in engineering units per calibration step, and
7.	DLTM	A time adjustment to be subtracted from the value at the fiducial mark, TSTART, which comes from the data file.

Some channels of data may not have a fiducial mark so the program has the option to skip that part. Time is then counted from the first sample.

These parameters and other control variables either have default values which can be changed using NAMELIST or are read in as card images. The details and an example are provided in Appendix E.

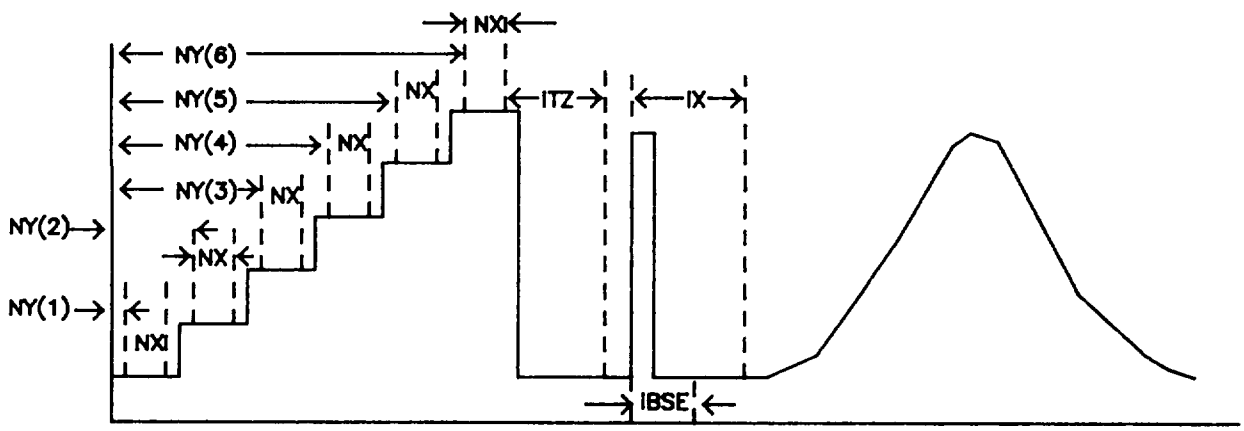


Figure 7. Graphic Explanation of Input Parameters

III. CONCLUSIONS

To convert experimental data digitized by IBD's HP1000 minicomputer system into the same computer file format required by existing computer programs, a four-step procedure has been devised. Separate steps are necessary because engineering judgments must be made before further processing is possible. These steps are:

1. Reading the data into a computer file,

2. Sorting the data so that all the data samples for one channel are contiguous in a file,

3. Editing the data so that unnecessary samples are not processed further, and

4. Converting the data into engineering units and creating an output file with the same format as previously generated in Reference 1.

This output file now contains the data in the format required for input into numerous experimental data analysis programs.

APPENDIX A

INPUT TO CYBER MFA VIA MODEM LINK ON HP9845

APPENDIX A

1. Preparation.

   a. Turn on HP9845 and 7906 disc drive.

   b. When disc drive is ready,

      LOAD "ANPACK:D12",10

      [EXECUTE]

   c. When menu appears,

      [K3] (Data Communications)

   d. Choose data link.

      1 [CONT] for HP1000 or 2 [CONT] for CDC

   e. Specify HP9845 file.

      When "terminal ready" message appears, indicating the terminal emulator program is loaded, then

      [K13] (1) To get into edit mode

      (2) It is not necessary to change any info on the first line. If you are going to the CDC and you do not want your password displayed on screen, you may want to change ECHO to ON by using [⟶] to space over and use STEP key to change to 'ON'.

      [STORE] - To store data communication information line

      (3) This line needs to be changed to the name of file and its size on the HP9845.

      Change TEST:TI5 to filename:C12

      Change SIZE=010 to # of records you want

      [STORE] - To store file info line

      (4) Will get a message that edit mode has been exited.

      (5) If this is a new file, then it must be created. If it is not, skip this step.

      [SHIFT] [K12] To create file on HP9845
      Answer "Y" to creation question. Message will appear on screen when creation is completed.

f. [CONT] Sends prompt to CDC or HP1000. Wait for LOGIN messages.

2. From CDC to HP9845.

a. LOGIN to CDC

b. Repeat I.E.(1) through I.E.(4), changing first edit line back to ECHO OFF if you turned it ON.

c. /GET,A=Pfn. (CR) = [CONT]

/ASSIGN,TT,B. (CR)

/COPYSBF,A,B. No (CR) !

[SHIFT] [K15] to turn record on

[CONT]

d. When finished recording,

[SHIFT] [K15] to turn record off

e. Log off CDC

/BYE

f. [SHIFT] [K4] to disconnect from CDC;

now back under control of HP9845.

3. From HP9845 to CDC

a. LOGIN to CDC

b. Repeat I.E.(1) through I.E.(4), changing first edit line back to ECHO OFF if you turned it ON.

c. Terminal definition defaults are set to emulate a Tektronix 4014 with a page width of 80 columns. If you need to set the terminal definition (TC parameter) to another terminal or the page width to a different size, then enter

/TRMDEF,TC= ,PW= .

See the NOS IAF Manual for parameter values. For most data transfers from the HP9845, the default parameters will be good and this step can be skipped.

d. Data transfer procedure:

NEW,LFN1
TEXT
'Enter Text Mode' message returned by CDC

[SHIFT] [K14]
"N" to handshake message from the HP9845
Data being transferred will be displayed on screen.
When all data has been transferred,

[CONTROL] [T] then [CONT] = (CR)

This terminates the input in TEXT mode and gets you back to READY mode in IAF.

e. Check the data transfer:

/REWIND,LFN1

/LIST,F=LFN1

f. To save the file:

/SAVE,LFN1=PFN/PW=_____,M=_____,CT=_____.

g. Disconnect procedure:

/BYE

[SHIFT] [K4]

4. From HP9845 to HP1000.

a. Log in to HP1000.

b. Repeat steps I.E.(1) to I.E.(4), changing file info line to correct file name and file size.

c. :ST,1,NAMR - No (CR) = [CONT]

[SHIFT] [K14] Upload

"N" to handshake question

[CONT]

d. When finished transferring to HP1000,

DO NOT [SHIFT] [K14] as this will cause great problems.

e. Be careful not to hit

[SHIFT] [K15] as this will write all kinds of error messages over your file on the HP9845.

f. Log off HP1000

:EX,SP

g. [SHIFT] [K4] to disconnect.

5. From HP1000 to HP9845.

a. Log in to HP1000.

b. Repeat steps I.E.(1) to I.E.(4), changing file info line to correct file name and file size.

c. ST, NAMR,1 No (CR) = [CONT]

[SHIFT] [K14] to turn record on

[CONT] to start recording

d. When finished recording,

[SHIFT] [K14] to turn record off

e. Log off HP1000

:EX,SP

f. [SHIFT] [K4] to disconnect

APPENDIX B

INPUT TO CYBER VIA MAGNETIC TAPE

APPENDIX B

1. MFA

```
Usern.
USER,username,password.
CHARGE,account,project number.
GET,HPTAPEB.
FILE,TAPE7,CM=NO.
BEGIN,GET,TAPE,LF=TAPE7,VSN=vsn,DEN=1600,TK=9,LABELED=NO,S.
     where vsn=tape library number
HPTAPEB.
REWIND,TAPE10.
SAVE,TAPE10=pfn.
     where pfn = name of disc file you are creating.
```

Note that input tape from the HP1000 must be on unit 7 and your output disc file is on unit 10.

2. MFZ

```
Usern,STMFZ,P4,NT1.
ACCOUNT,account.
BEGIN,READZ,HPTAPEP,VSN=vsn,PF=pfn,ID=userid.

    where  vsn = tape library number,
           pfn = name of disc file you are creating, and
           userid = your ID on MFZ.
```

It is strongly recommended that you use this procedure and copy your file from MFZ to MFA if you need the data on MFA.

3. Listing of MFA file ADTAPE1/UN=BOOTS:

```
BOOTS,STMFZ,P6,NT1.
ACCOUNT,PDxxx.
BEGIN,READZ,HPTAPEP,VSN=6978,PF=LOLA2,ID=BOOTS.
```

APPENDIX C

IMPLEMENTATION OF STEP 2

APPENDIX C.1.a

Listing of MFA File ADTAPE2/UN=BOOTS

APPENDIX C.1.a

Listing of MFA File ADTAPE2/UN=BOOTS

a. Job Control Language

```
BOOTS,STMFZ,P6,T100.
ACCOUNT,PDxxx.
BEGIN,ATTACH,PLOTLIB.
ATTACH,TAPE1,LOLA2,ID=BOOTS.
REQUEST,TAPE3,*PF.
REQUEST,TAPE2,*PF.
REQUEST,TAPE13,*PF.
FTN,R=0.
LGO.
EXIT,U.
BEGIN,PLOT,CALCOMP,TAPE13.
CATALOG,TAPE3,LOLAD,ID=BOOTS.
CATALOG,TAPE13,PLTT,ID=BOOTS.
```

APPENDIX C.1.b

Program

```
      PROGRAM RDMTD(INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,TAPE1,TAPE3,
     * TAPE13,TAPE14,TAPE15,TAPE16,TAPE17,TAPE18,TAPE19,TAPE2,
     * TAPE20,TAPE21,TAPE22,TAPE23,TAPE24,TAPE25,TAPE26)
      COMMON ISTOR(2500),COUNT(2500),NCH,NBLK,NU,K,IRD,CH1(2500),IK,ISU,
     * CH2(2500),CH3(2500),CH4(2500),CH5(2500),CH6(2500),CH7(2500),NCY,
     * CH8(2500),CH9(2500),CH10(2500),CH11(2500),CH12(2500),CAL(2500)
     *,NCAL,NCHA,MSSG(8),IPL,IDIM,NAMEF,DT,JJ,NUS
      IDIM=2500
      IPL=1
      IRD=0
   50 WRITE(6,1000)
      CALL RDDTA(1)
      DO 60 IU=14,26
      REWIND IU
   60 CONTINUE
      IRD=IRD+1
      NBR=NCH*(IDIM/NU)
      NCY=NBLK/NBR
      IF(NBLK-NCY*NBR.NE.0) NCY=NCY+1
      ISU=1
      IK=1
      NUS=0
      NCAL=0
      NCHA=0
      DO 500 I=1,NCY
      IF(I.EQ.NCY.AND.IABS(NBLK-NCY*NBR).NE.0)NBR=IABS(NBLK-(NCY-1)*NBR)
      DO 100 N=1,NBR
      CALL RDDTA(2)
      CALL DEFULT(N)
  100 CONTINUE
      K=K-1
      CALL WRTDTA
  500 CONTINUE
      WRITE(6,1100) NCAL,NCHA
      CALL WRTTPE
      GO TO 50
 1000 FORMAT(1H1)
 1100 FORMAT(' NO. OF CAL BLKS',I10,5X,'NO. OF DATA BLKS',I10)
      END
```

```
      SUBROUTINE DEMULT(ICYL)
      COMMON ISTOR(2500),COUNT(2500),NCH,NBLK,NU,K,IRD,CH1(2500),IK,ISW
     *,CH2(2500),CH3(2500),CH4(2500),CH5(2500),CH6(2500),CH7(2500),NCY,
     * CH8(2500),CH9(2500),CH10(2500),CH11(2500),CH12(2500),CAL(2500)
     *,NCAL,NCHA,MSSG(8),IPL,IDIM,NAMEF,DT,JJ,NUS
      IF(ICYL.EQ.1)JJ=0
      IF(RJ.EQ..0)JJ=0
      IF(JJ.EQ.0)MS=1
      IF(ICYL.EQ.1)K=1
      NUS=NUS+NU
      RJ=MOD(NUS,NCH)
      IF(JJ.GT.0)GOTO115
   90 DO 100 M=MS,NU,NCH
      IF(RJ.GT.0..AND.M+NCH.GT.NU) GO TO 110
      IF(ISW.EQ.1) IK=K
      ISW=2
      IF(NCH.GE.1) CH1(K)=ISTOR(M)
      IF(NCH.GE.2) CH2(K)=ISTOR(M+1)
      IF(NCH.GE.3) CH3(K)=ISTOR(M+2)
      IF(NCH.GE.4) CH4(K)=ISTOR(M+3)
      IF(NCH.GE.5) CH5(K)=ISTOR(M+4)
      IF(NCH.GE.6) CH6(K)=ISTOR(M+5)
      IF(NCH.GE.7) CH7(K)=ISTOR(M+6)
      IF(NCH.GE.8) CH8(K)=ISTOR(M+7)
      IF(NCH.GE.9) CH9(K)=ISTOR(M+8)
      IF(NCH.GE.10) CH10(K)=ISTOR(M+9)
      IF(NCH.GE.11) CH11(K)=ISTOR(M+10)
      IF(NCH.GE.12) CH12(K)=ISTOR(M+11)
      GO TO 60
   50 CAL(K)=ISTOR(M)
   60 K=K+1
      IF(K.EQ.11.AND.ISW.EQ.1) WRITE(6,1000) IRD, (CAL(J),J=1,10)
      IF(K.EQ.11.AND.ISW.EQ.2) WRITE(6,1000) IRD, (CH1(J),J=1,10)
  100 CONTINUE
      RETURN
  110 JJ=NU-M+1
      MM=NU-JJ+1
      GO TO 120
  115 MM=-JJ+1
      JS=JJ
      JI=JJ+1
      JJ=NCH
      MS=NCH-JS+1
      GO TO (120,121,122,123,124,125,126,127,128,129,130,131),JI
  120 IF(JJ.GE.1) CH1(K)=ISTOR(MM)
  121 IF(JJ.GE.2) CH2(K)=ISTOR(MM+1)
  122 IF(JJ.GE.3) CH3(K)=ISTOR(MM+2)
  123 IF(JJ.GE.4) CH4(K)=ISTOR(MM+3)
  124 IF(JJ.GE.5) CH5(K)=ISTOR(MM+4)
  125 IF(JJ.GE.6) CH6(K)=ISTOR(MM+5)
  126 IF(JJ.GE.7) CH7(K)=ISTOR(MM+6)
  127 IF(JJ.GE.8) CH8(K)=ISTOR(MM+7)
  128 IF(JJ.GE.9) CH9(K)=ISTOR(MM+8)
  129 IF(JJ.GE.10) CH10(K)=ISTOR(MM+9)
  130 IF(JJ.GE.11) CH11(K)=ISTOR(MM+10)
  131 IF(JJ.GE.12) CH12(K)=ISTOR(MM+11)
      IF(JJ.EQ.NCH)K=K+1
      IF(JJ.EQ.NCH)GO TO 90
      RETURN
 1000 FORMAT(1H ,I6,10F8.0)
      END
```

```
      SUBROUTINE PLAT(IPLOT,DATA,IRD1,IMU)
      COMMON ISTOR(2500),COUNT(2500),NCH,NBLK,NU,K,IRD,CH1(2500),IK,ISW
     *,CH2(2500),CH3(2500),CH4(2500),CH5(2500),CH6(2500),CH7(2500),NCY,
     * CH8(2500),CH9(2500),CH10(2500),CH11(2500),CH12(2500),CAL(2500)
     *,NCAL,NCHA,MSSG(8),IPL,IDIM,NAMEF,DT,JJ,NWS
      DIMENSION LABEL(4), DATA(2500),ITITLE(3)
      IF(IPLOT.GT.1) GO TO 100
      IPLOT=2
      XB=1.75
      YB=.4
      XAX=5.
      YAX=4.
      XPAGE=7.
      YPAGE=4.75
      FACT=1.
      IUNIT=13
      LABEL(1)=10H BOOTS 390
      LABEL(2)=10H 6121
      LABEL(3)=10HRAW DATA
      LABEL(4)=10HLOLA2
      MODE=1
      CALL PLTBEG(XPAGE,YPAGE,FACT,IUNIT,LABEL)
      XMI=0.
      XMA=IDIM
      YMI=0.
      YMA=5000.
      DX=500.
      DY=1000.
      XS=(XMA-XMI)/XAX
      YS=(YMA-YMI)/YAX
  100 CALL PLTSCA(XB,YB,XMI,YMI,XS,YS)
      CALL PLTUND(XMI,XMA,YMI,YMA)
      CALL PLTAXS(DX,DY,XMI,XMA,YMI,YMA,4)
      CALL LABELA(DX,DY,XMI,XMA,YMI,YMA,1.,1.)
      ENCODE(30,1000,ITITLE) IRD1,IMU
 1000 FORMAT(3H ID,I10,8H    PLOT,I8,1H))
      TX=XMI
      TY=YMA+.05*YS
      CHT=.1
      CALL PLTSYM(CHT,ITITLE(1),0.,TX,TY)
      TIC=DX*DT*1000.
      TIME=DT*FLOAT(NU)*1000.
      TY=YMA+.20*YS
      ENCODE(12,2000,ITITLE)NAMEF
 2000 FORMAT(1H ,A10,1H))
      CALL PLTSYM(CHT,ITITLE,0.,TX,TY)
      TX=XMI-XS*1.55
      TY=YMA-YS*.3
      ITITLE(1)=10HTIME, MS)
      CALL PLTSYM(CHT,ITITLE,0.,TX,TY)
      TY=YMA-YS*.45
      ENCODE(16,3000,ITITLE)TIME
 3000 FORMAT(8H /FRAME=,F7.3,1H))
      CALL PLTSYM(CHT,ITITLE,0.,TX,TY)
      TY=YMA-YS*.6
      ENCODE(16,4000,ITITLE)TIC
 4000 FORMAT(8H /TIC=  ,F7.3,1H))
      CALL PLTSYM(CHT,ITITLE,0.,TX,TY)
      CALL PLTDTS(MODE,0,COUNT(1),DATA(1),NU,0)
      CALL PLTPGE
      RETURN
      END
```

```
      SUBROUTINE RDDTA(ICODE)
      COMMON ISTOR(2500),COUNT(2500),NCH,NBLK,NW,K,IRD,CH1(2500),IK,ISW
     *,CH2(2500),CH3(2500),CH4(2500),CH5(2500),CH6(2500),CH7(2500),NCY,
     * CH8(2500),CH9(2500),CH10(2500),CH11(2500),CH12(2500),CAL(2500)
     *,NCAL,NCHA,MSSG(8),IPL,IDIM,NAMEF,DT,JJ,NWS
      IF(ICODE.NE.1) GO TO 200
      READ(1)ITYPE,NAMEF,MSSG,NCH,NW,NREC,NBLK,SRATE,IPBR,DT,SAMPS
      IF(EOF(1).NE.0.) STOP
      WRITE(6,1)NAMEF,NCH,NBLK,NW,DT
      RETURN
  200 IF(ICODE.NE.2) GO TO 300
      READ(1) NW,(ISTOR(I),I=1,NW)
      IF(EOF(1).NE.0.) STOP
      RETURN
  300 WRITE(6,2)ICODE
      RETURN
    1 FORMAT(//,' FILE NAME ',A10,13X,' NO. OF CHANNELS = ',I5/
     *       ' NO. OF RECORDS = ',I10,6X,' LENGTH OF A RECORD = ',I10/
     *       ' TIME INCREMENT,SEC = ',E12.5//)
    2 FORMAT(' RDDATA ERROR, ICODE = ',I10)
      END
```

```
      SUBROUTINE WRTDTA
      COMMON ISTOR(2500),COUNT(2500),NCH,NBLK,NW,K,IRD,CH1(2500),IK,ISW,
     * CH2(2500),CH3(2500),CH4(2500),CH5(2500),CH6(2500),CH7(2500),NCY,
     * CH8(2500),CH9(2500),CH10(2500),CH11(2500),CH12(2500),CAL(2500)
     *,NCAL,NCHA,MSSG(8),IPL,IDIM,NAMEF,DT,JJ,NUS
      IF(ISW.EQ.2) GO TO 40
      WRITE(14) K,(CAL(J),J=1,K)
      NCAL=NCAL+1
      RETURN
   40 IF(IK.EQ.1.AND.ISW.EQ.2) GO TO 50
      KK=IK-1
      IF(KK.NE.0)WRITE(14) KK,(CAL(J),J=1,KK)
      IF(KK.NE.0)NCAL=NCAL+1
      IJ=K-KK
      IF(NCH.GE.1) WRITE(15) IJ,(CH1(J),J=IK,K)
      IF(NCH.GE.2) WRITE(16) IJ,(CH2(J),J=IK,K)
      IF(NCH.GE.3) WRITE(17) IJ,(CH3(J),J=IK,K)
      IF(NCH.GE.4) WRITE(18) IJ,(CH4(J),J=IK,K)
      IF(NCH.GE.5) WRITE(19) IJ,(CH5(J),J=IK,K)
      IF(NCH.GE.6) WRITE(20) IJ,(CH6(J),J=IK,K)
      IF(NCH.GE.7) WRITE(21) IJ,(CH7(J),J=IK,K)
      IF(NCH.GE.8) WRITE(22) IJ,(CH8(J),J=IK,K)
      IF(NCH.GE.9) WRITE(23) IJ,(CH9(J),J=IK,K)
      IF(NCH.GE.10) WRITE(24) IJ,(CH10(J),J=IK,K)
      IF(NCH.GE.11) WRITE(25) IJ,(CH11(J),J=IK,K)
      IF(NCH.GE.12) WRITE(26) IJ,(CH12(J),J=IK,K)
      IK=1
      NCHA=NCHA+1
      RETURN
   50 IF(NCH.GE.1) WRITE(15) K,(CH1(J),J=1,K)
      IF(NCH.GE.2) WRITE(16) K,(CH2(J),J=1,K)
      IF(NCH.GE.3) WRITE(17) K,(CH3(J),J=1,K)
      IF(NCH.GE.4) WRITE(18) K,(CH4(J),J=1,K)
      IF(NCH.GE.5) WRITE(19) K,(CH5(J),J=1,K)
      IF(NCH.GE.6) WRITE(20) K,(CH6(J),J=1,K)
      IF(NCH.GE.7) WRITE(21) K,(CH7(J),J=1,K)
      IF(NCH.GE.8) WRITE(22) K,(CH8(J),J=1,K)
      IF(NCH.GE.9) WRITE(23) K,(CH9(J),J=1,K)
      IF(NCH.GE.10) WRITE(24) K,(CH10(J),J=1,K)
      IF(NCH.GE.11) WRITE(25) K,(CH11(J),J=1,K)
      IF(NCH.GE.12) WRITE(26) K,(CH12(J),J=1,K)
      WRITE(6,1)NCY,NCHA,K,(CH1(J),J=1,10)
    1 FORMAT(3I10,10F7.0)
      NCHA=NCHA+1
      RETURN
      END
```

```
      SUBROUTINE URTTPE
      COMMON ISTOR(2500),COUNT(2500),NCH,NBLK,NW,K,IRD,CH1(2500),IK,ISW,
     * CH2(2500),CH3(2500),CH4(2500),CH5(2500),CH6(2500),CH7(2500),NCY,
     * CH8(2500),CH9(2500),CH10(2500),CH11(2500),CH12(2500),CAL(2500)
     * ,NCAL,NCHA,MSSG(8),IPL,IDIM,NAMEF,DT,JJ,NWS
      DIMENSION DATA(2500)
      DO 5 I=1,IDIM
      COUNT(I)=I
    5 CONTINUE
      ITPE=14
      IPL=1
      IF(NCAL.EQ.0)GO TO 300
      WRITE(2)NAMEF
      IRD1=IRD+10000
      WRITE(2) IRD1,DT,NCH,NCAL
      REWIND ITPE
      DO 200 N=1,NCAL
      READ(ITPE) NW,(DATA(J),J=1,NW)
      IF(N.EQ.1) WRITE(6,1000) IRD1,NW,(DATA(J),J=1,10)
      IF(N.EQ.NCAL/2) WRITE(6,1000) IRD1,NW,(DATA(J),J=1,10)
      IF(N.EQ.NCAL) WRITE(6,1000) IRD1,NW,(DATA(J),J=1,10)
      IF(N.EQ.1)CALL PLAT(IPL,DATA,IRD1,N)
      WRITE(2) NW,(DATA(J),J=1,NW)
  200 CONTINUE
  300 ITPE=ITPE+1
      WRITE(3)NAMEF
      WRITE(3) IRD,DT,NCH,NCHA
      DO 600 N=1,NCH
      IRD1=IRD+100*N
      REWIND ITPE
      DO 400 I=1,NCHA
      READ(ITPE) NW,(DATA(J),J=1,NW)
      IF(I.EQ.1)WRITE(6,1000)ITPE,NCHA
      IF(I.EQ.1)WRITE(6,1000)NCH
      IF(I.EQ.1) WRITE(6,1000) IRD1,NW,(DATA(J),J=1,10)
      IF(I.EQ.NCHA/2) WRITE(6,1000) IRD1,NW,(DATA(J),J=1,10)
      IF(I.EQ.NCHA) WRITE(6,1000) IRD1,NW,(DATA(J),J=1,10)
      IF(N.EQ.1)CALL PLAT (IPL,DATA,IRD1,I)
      WRITE(3) NW,(DATA(J),J=1,NW)
  400 CONTINUE
      ITPE=ITPE+1
  600 CONTINUE
      RETURN
 1000 FORMAT(1H ,2I10,10F8.0)
      END
```

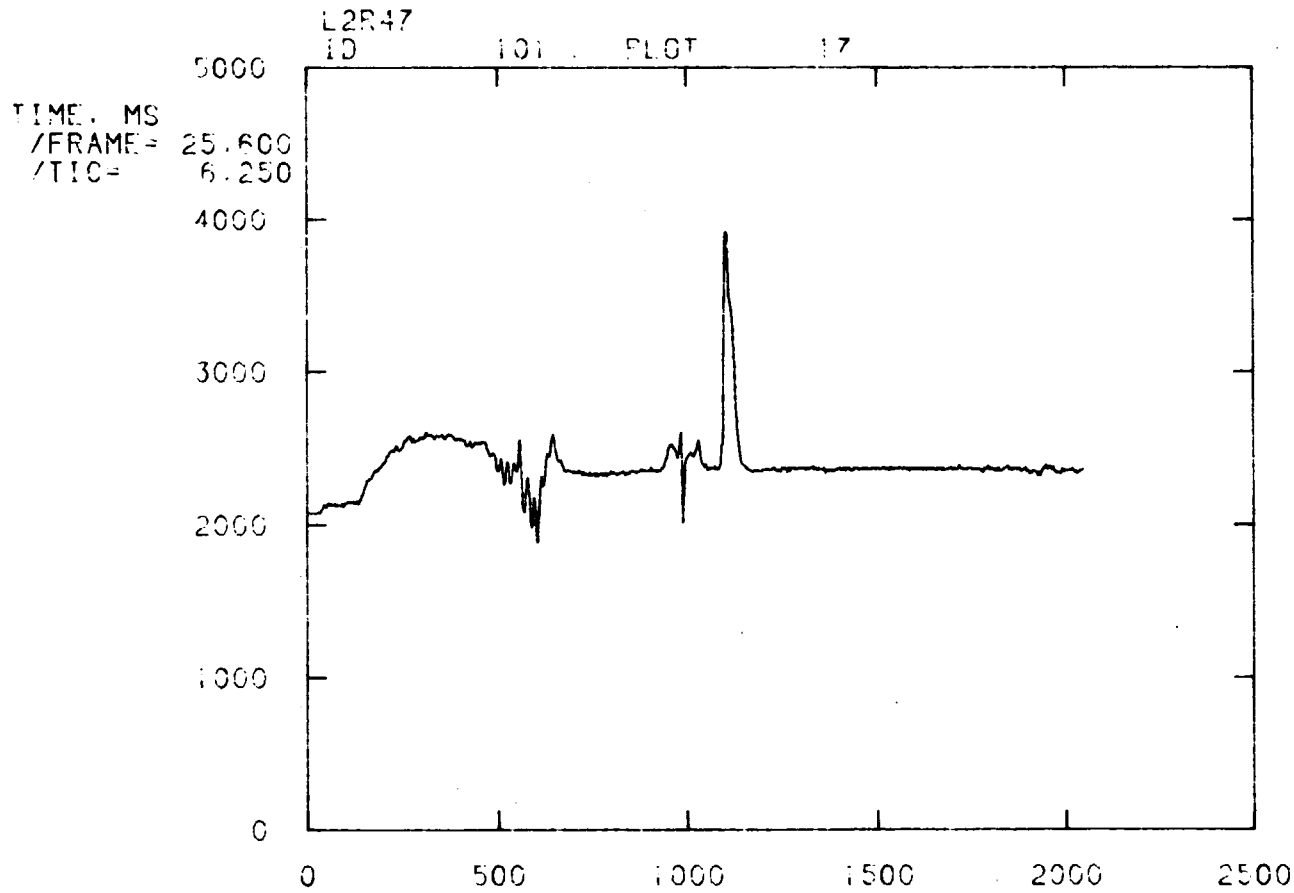
APPENDIX C.2

Sample Output

FILE NAME L2R47 NO. OF CHANNELS = 4
NO. OF RECORDS = 200 LENGTH OF A RECORD = 1024
TIME INCREMENT,SEC = .12500E-04

1	2168.	2165.	2162.	2163.	2162.	2160.	2158.	2158.	2163.	2167.	
25	0	2048	2168.	2165.	2162.	2163.	2162.	2160.	2158.	2158.	2163.	2167.
1	2142.	2143.	2144.	2140.	2140.	2143.	2151.	2155.	2150.	2143.		
25	1	2048	2142.	2143.	2144.	2140.	2140.	2143.	2151.	2155.	2150.	2143.
1	2121.	2123.	2124.	2124.	2119.	2118.	2118.	2123.	2129.	2127.		
25	2	2048	2121.	2123.	2124.	2124.	2119.	2118.	2118.	2123.	2129.	2127.
1	2089.	2094.	2096.	2095.	2090.	2091.	2099.	2100.	2097.	2092.		
25	3	2048	2089.	2094.	2096.	2095.	2090.	2091.	2099.	2100.	2097.	2092.
1	2358.	2359.	2360.	2363.	2363.	2364.	2368.	2371.	2367.	2365.		
25	4	2048	2358.	2359.	2360.	2363.	2363.	2364.	2368.	2371.	2367.	2365.
1	2368.	2363.	2361.	2360.	2366.	2374.	2375.	2369.	2362.	2360.		
25	5	2048	2368.	2363.	2361.	2360.	2366.	2374.	2375.	2369.	2362.	2360.
1	2645.	2639.	2636.	2635.	2634.	2634.	2637.	2643.	2646.	2644.		
25	6	2048	2645.	2639.	2636.	2635.	2634.	2634.	2637.	2643.	2646.	2644.
1	2636.	2646.	2650.	2646.	2639.	2632.	2625.	2624.	2628.	2634.		
25	7	2048	2636.	2646.	2650.	2646.	2639.	2632.	2625.	2624.	2628.	2634.
1	2900.	2902.	2903.	2906.	2912.	2919.	2922.	2917.	2913.	2911.		
25	8	2048	2900.	2902.	2903.	2906.	2912.	2919.	2922.	2917.	2913.	2911.
1	2916.	2916.	2911.	2905.	2900.	2898.	2904.	2912.	2915.	2917.		
25	9	2048	2916.	2916.	2911.	2905.	2900.	2898.	2904.	2912.	2915.	2917.
1	3193.	3193.	3190.	3187.	3184.	3185.	3186.	3186.	3186.	3188.		
25	10	2048	3193.	3193.	3190.	3187.	3184.	3185.	3186.	3186.	3186.	3188.
1	3184.	3188.	3190.	3191.	3194.	3195.	3192.	3186.	3181.	3181.		
25	11	2048	3184.	3188.	3190.	3191.	3194.	3195.	3192.	3186.	3181.	3181.
1	3467.	3466.	3468.	3469.	3468.	3465.	3463.	3462.	3460.	3461.		
25	12	2048	3467.	3466.	3468.	3469.	3468.	3465.	3463.	3462.	3460.	3461.
1	3464.	3461.	3463.	3467.	3470.	3469.	3469.	3469.	3468.	3463.		
25	13	2048	3464.	3461.	3463.	3467.	3470.	3469.	3469.	3469.	3468.	3463.
1	2094.	2092.	2091.	2097.	2097.	2097.	2094.	2094.	2099.	2096.		
25	14	2048	2094.	2092.	2091.	2097.	2097.	2097.	2094.	2094.	2099.	2096.
1	2089.	2082.	2079.	2085.	2086.	2085.	2082.	2082.	2089.	2093.		
25	15	2048	2089.	2082.	2079.	2085.	2086.	2085.	2082.	2082.	2089.	2093.
1	2082.	2083.	2088.	2087.	2080.	2077.	2078.	2085.	2084.	2077.		
25	16	2048	2082.	2083.	2088.	2087.	2080.	2077.	2078.	2085.	2084.	2077.
1	2366.	2366.	2370.	2371.	2373.	2375.	2374.	2370.	2373.	2378.		
25	17	2048	2366.	2366.	2370.	2371.	2373.	2375.	2374.	2370.	2373.	2378.
1	2367.	2368.	2365.	2363.	2367.	2369.	2369.	2367.	2369.	2372.		
25	18	2048	2367.	2368.	2365.	2363.	2367.	2369.	2369.	2367.	2369.	2372.
1	2299.	2308.	2319.	2330.	2338.	2344.	2352.	2358.	2362.	2365.		
25	19	2048	2299.	2308.	2319.	2330.	2338.	2344.	2352.	2358.	2362.	2365.
1	2376.	2377.	2377.	2371.	2367.	2369.	2373.	2376.	2378.	2377.		
25	20	2048	2376.	2377.	2377.	2371.	2367.	2369.	2373.	2376.	2378.	2377.
1	2385.	2385.	2385.	2382.	2374.	2368.	2369.	2378.	2383.	2375.		
25	21	2048	2385.	2385.	2385.	2382.	2374.	2368.	2369.	2378.	2383.	2375.
1	2377.	2368.	2367.	2370.	2371.	2375.	2376.	2369.	2363.	2365.		
25	22	2048	2377.	2368.	2367.	2370.	2371.	2375.	2376.	2369.	2363.	2365.
1	2367.	2366.	2369.	2372.	2373.	2373.	2369.	2370.	2374.	2376.		
25	23	2048	2367.	2366.	2369.	2372.	2373.	2373.	2369.	2370.	2374.	2376.

```
     1   2377.   2381.   2387.   2391.   2388.   2382.   2379.   2376.   2374.   2371.
    25      84    2048   2377.   2381.   2387.   2391.   2388.   2382.   2379.   2376.   2374.   2371.
NO. OF CAL BLKS          0     NO. OF DATA BLKS          25
    15      25
     4
   101    2048   2168.   2165.   2162.   2163.   2162.   2160.   2158.   2158.   2163.   2167.
   101    2048   3184.   3188.   3190.   3191.   3194.   3195.   3192.   3186.   3181.   3181.
   101    2048   2377.   2381.   2387.   2391.   2388.   2382.   2379.   2376.   2374.   2371.
    16      25
     4
   201    2048   2042.   2037.   2035.   2032.   2029.   2028.   2027.   2036.   2044.   2045.
   201    2048   3029.   3022.   3016.   3018.   3023.   3026.   3023.   3025.   3031.   3036.
   201    2048   2031.   2036.   2040.   2044.   2040.   2040.   2042.   2042.   2045.   2041.
    17      25
     4
   301    2048   2726.   2725.   2719.   2722.   2724.   2722.   2720.   2727.   2732.   2735.
   301    2048   1204.   1197.   1201.   1210.   1213.   1217.   1218.   1216.   1206.   1199.
   301    2048   3412.   3413.   3403.   3398.   3404.   3411.   3410.   3403.   3400.   3411.
    18      25
     4
   401    2048   2565.   2569.   2575.   2576.   2569.   2559.   2552.   2552.   2559.   2564.
   401    2048   1183.   1181.   1180.   1178.   1179.   1188.   1195.   1195.   1188.   1177.
   401    2048   3405.   3402.   3406.   3410.   3410.   3401.   3399.   3403.   3405.   3404.
```


L2R47
ID 101 . PLOT 17
TIME. MS
/FRAME= 25.600
/TIC= 6.250
5000
4000
3000
2000
1000
0
0
500
1000
1500
2000
2500

APPENDIX D

IMPLEMENTATION OF STEP 3

APPENDIX D.1.a

Listing of MFA File ADTAPE3/UN=BOOTS

APPENDIX D.1.a

Listing of MFA File ADTAPE3/UN=BOOTS

a. Job Control Language

```
BOOTS,STMFZ,P6,T30.
ACCOUNT,PDxxx.
BEGIN,ATTACH,PLOTLIB.
ATTACH,TAPE1,LOLAD,ID=BOOTS.
REQUEST,TAPE3,*PF.
REQUEST,TAPE13,*PF.
FTN,R=0.
MAP,OFF.
LGO.
CATALOG,TAPE3,LOLAED,ID=BOOTS.
CATALOG,TAPE13,PLT,ID=BOOTS.
BEGIN,PLOT,CALCOMP,TAPE13.
```

APPENDIX D.1.b

Program

```
      PROGRAM EDITAD(INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,TAPE1,TAPE3,
     * TAPE13)
      COMMON TEMP(2500),COUNT(23000),DATA(23000),IPL,ICNT,NTS(24),
     * NCH,NW,IRD,NCHA,IDIM,NAMEF,DT,NPT,TIME,IFRA(6),ISAM(2)
      IDIM=23000
      WRITE(6,1000)
   50 CALL RDDTA(1)
      IPL=1
      DO 500 I=1,NCH
      ICNT=I
      NPT=0
      DO 100 N=1,NCHA
      CALL RDDTA(2)
      CALL EDIT(N)
  100 CONTINUE
      IF(NPT.EQ.0)GO TO 500
      CALL WRTTPE
  500 CONTINUE
      GO TO 50
 1000 FORMAT(1H1)
      END
```

```
      SUBROUTINE EDIT(N)
      COMMON TEMP(2500),COUNT(23000),DATA(23000),IPL,ICNT,NTS(24),
     * NCH,NW,IRD,NCHA,IDIM,NAMEF,DT,NPT,TIME,IFRA(6),ISAM(2)
      IF(NPT.GE.IDIM)GO TO 500
      IF(N.LT.IFRA(1))GO TO 500
      IF(N.GE.IFRA(6))GO TO 500
      IF(N.GE.IFRA(2).AND.N.LT.IFRA(3))GO TO 500
      IF(N.GE.IFRA(4).AND.N.LT.IFRA(5))GO TO 400
      ISKP=ISAM(2)
      IF(N.LT.IFRA(2))ISKP=ISAM(1)
      DO 100 I=1,NW,ISKP
      NPT=NPT+1
      DATA(NPT)=TEMP(I)
      IF(NPT.GE.IDIM)GO TO 300
      IF(I+ISKP.GT.NW)GO TO 200
  100 CONTINUE
  200 GO TO 500
  300 WRITE(6,1)IDIM
      GO TO 500
  400 TIME=TIME+DT*FLOAT(NW)/FLOAT(NCH)
  500 RETURN
    1 FORMAT(' WARNING -- DATA BLOCK EXCEEDS ',I10)
      END
```

```
      SUBROUTINE RDDTA(ICODE)
      COMMON TEMP(2500),COUNT(23000),DATA(23000),IPL,ICNT,NTS(24),
     * NCH,NW,IRD,NCHA,IDIM,NAMEF,DT,NPT,TIME,IFRA(6),ISAM(2)
      IF(ICODE.NE.1) GO TO 200
      READ(1)NAMEF
      IF(EOF(1).NE.0.) STOP
      READ(1)IRD,DT,NCH,NCHA
      WRITE(6,1)NAMEF,NCH,DT,NCHA
      IF(IRD.LT.10000)WRITE(6,4)
      IF(IRD.GE.10000)WRITE(6,5)
      READ(5,3)IFRA,ISAM,IMSG
      IF(EOF(5).NE..0)STOP
      DO 100 I=1,24
      NTS(I)=2H
  100 CONTINUE
      IF(IMSG.NE.0)READ(5,6)(NTS(I),I=13,24)
      TIME=.0
      IF(ISAM(1).EQ.0)ISAM(1)=1
      IF(ISAM(2).EQ.0)ISAM(2)=1
      WRITE(6,3)IFRA,ISAM,IMSG
      DT=DT*FLOAT(ISAM(2))
      RETURN
  200 IF(ICODE.NE.2) GO TO 300
      READ(1) NW,(TEMP(I),I=1,NW)
      IF(EOF(1).NE.0.) STOP
      RETURN
  300 WRITE(6,2)ICODE
      RETURN
    1 FORMAT(//,' FILE NAME ',A10,13X,' NO. OF CHANNELS = ',I5/
     *       ' TIME INCREMENT,SEC = ',E12.5,' NO. OF DATA SUBSETS = ',
     *       I5//)
    2 FORMAT(' RDDATA ERROR, ICODE = ',I10)
    3 FORMAT(9I5)
    4 FORMAT(' DATA CHANNEL')
    5 FORMAT(' CALIBRATION CHANNEL')
    6 FORMAT(12A2)
      END
```

```
      SUBROUTINE PLAT(IPLOT,IRD1)
      COMMON TEMP(2500),COUNT(23000),DATA(23000),IPL,ICNT,NTS(24),
     X NCH,NW,IRD,NCHA,IDIM,NAMEF,DT,NPT,TIME,IFRA(6),ISAM(2)
      DIMENSION LABEL(4),ITITLE(3)
      IF(IPLOT.GT.1) GO TO 100
      IPLOT=2
      XB=1.75
      YB=.4
      XS=500.
      DX=500.
      XMI=.0
      XAX=NPT/500+1
      XMA=XS*XAX
      YAX=4.
      XPAGE=XAX+2.2
      YPAGE=4.75
      FACT=1.
      IUNIT=13
      LABEL(1)=10H BOOTS 390
      LABEL(2)=10H 6121
      LABEL(3)=10HEDITTED DA
      LABEL(4)=10HTA - LOLA2
      MODE=1
      CALL PLTBEG(XPAGE,YPAGE,FACT,IUNIT,LABEL)
      YMI=0.
      YMA=5000.
      DY=1000.
      YS=(YMA-YMI)/YAX
  100 CALL PLTSCA(XB,YB,XMI,YMI,XS,YS)
      CALL PLTWND(XMI,XMA,YMI,YMA)
      CALL PLTAXS(DX,DY,XMI,XMA,YMI,YMA,4)
      CALL LABELA(DX,DY,XMI,XMA,YMI,YMA,1.,1.)
      ENCODE(30,1000,ITITLE) IRD1
 1000 FORMAT(3H ID,I10,8H    PLOT,8X,1H))
      TX=XMI
      TY=YMA+.05*YS
      CHT=.1
      CALL PLTSYM(CHT,ITITLE(1),0.,TX,TY)
      TIC=DX*DT*1000.
      TIM=DT*FLOAT(NPT)*1000.
      TY=YMA+.20*YS
      ENCODE(12,2000,ITITLE)NAMEF
 2000 FORMAT(1H ,A10,1H))
      CALL PLTSYM(CHT,ITITLE,0.,TX,TY)
      TX=XMI-XS*1.55
      TY=YMA-YS*.3
      ITITLE(1)=10HTIME, MS)
      CALL PLTSYM(CHT,ITITLE,0.,TX,TY)
      TY=YMA-YS*.45
      ENCODE(16,3000,ITITLE)TIM
 3000 FORMAT(8H /FRAME=,F7.3,1H))
      CALL PLTSYM(CHT,ITITLE,0.,TX,TY)
      TY=YMA-YS*.6
      ENCODE(16,4000,ITITLE)TIC
 4000 FORMAT(8H /TIC=  ,F7.3,1H))
      CALL PLTSYM(CHT,ITITLE,0.,TX,TY)
      CALL PLTDTS(MODE,0,COUNT(1),DATA(1),NPT,0)
      CALL PLTPGE
      RETURN
      END
```

```
      SUBROUTINE WRTTPE
      COMMON TEMP(2500),COUNT(23000),DATA(23000),IPL,ICNT,NTS(24),
     X NCH,MU,IRD,NCHA,IDIM,NAMEF,DT,NPT,TIME,IFRA(6),ISAM(2)
      DO 5 I=1,IDIM
      COUNT(I)=I
    5 CONTINUE
      DECODE(10,2000,NAMEF)(NTS(I),I=1,5)
      ENCODE( 6,3000,MDUM )IRD
      DECODE( 6,2000,MDUM )(NTS(I),I=8,10)
      ENCODE(2,4000,NTS(11))ICNT
      ENCODE( 2,4000,NTS(12))NCH
      WRITE(3)NTS
      WRITE(3) NPT
      WRITE(3)TIME,DT
      WRITE(6,1000)NTS,NPT,TIME,DT
      CALL PLAT (IPL,IRD)
      WRITE(3) (DATA(J),J=1,NPT)
      WRITE(6,5000)(DATA(J),J=1,20)
      RETURN
 1000 FORMAT(' NTS = ',24A2,' NPT = ',I10,' START TIME =  ',
     X       E12.5,' DT = ',E12.5)
 2000 FORMAT(5A2)
 3000 FORMAT(I6)
 4000 FORMAT(I2)
 5000 FORMAT(10F10.0)
      END
```

APPENDIX D.1.c

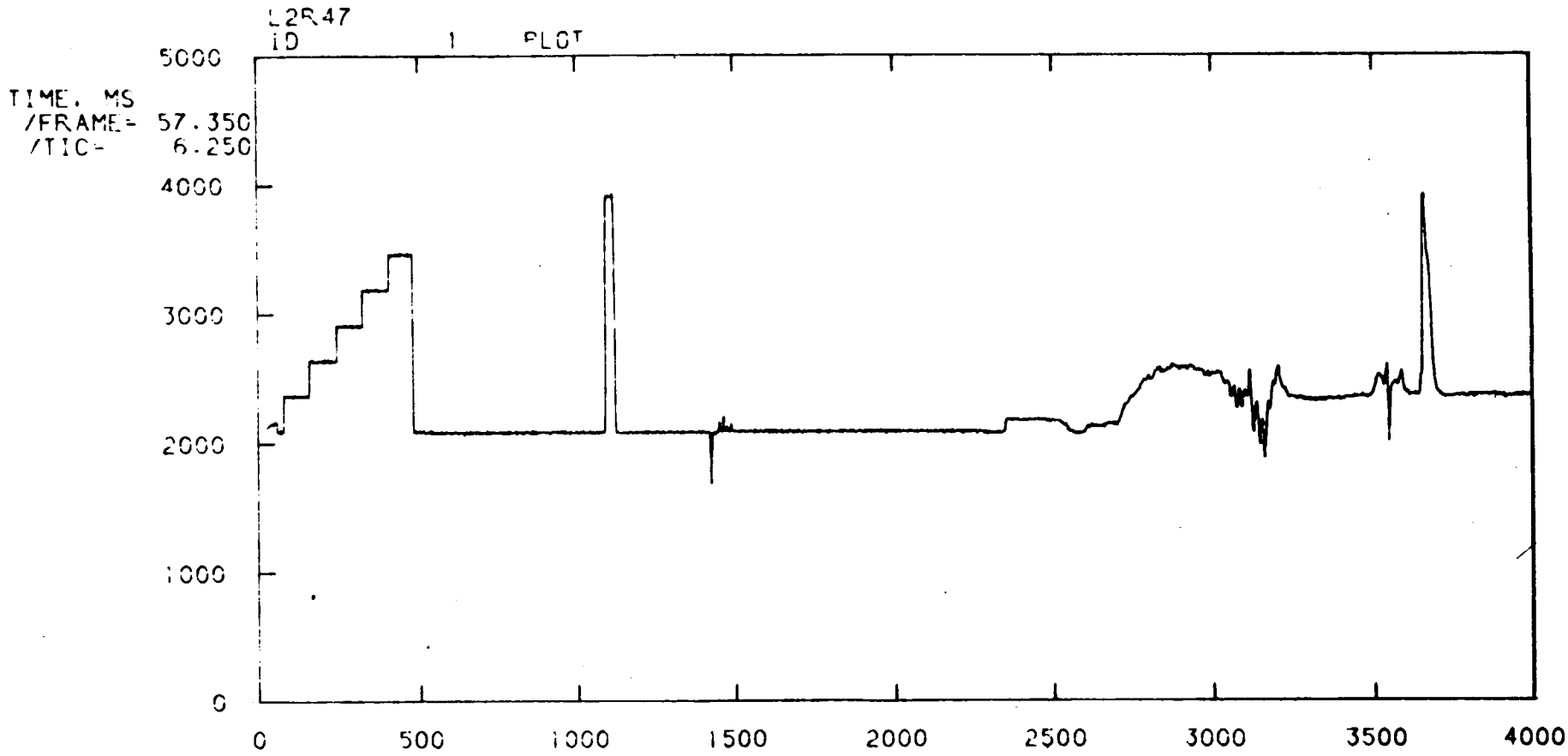
Input Card Images

3	15	16	16	16	18	50	1	0
4	5	5	6	6	27	50	2	0
2	13	14	14	14	18	50	1	0
5	6	6	7	7	28	50	2	0
3	4	4	5	5	26	50	2	0
4	15	17	17	17	19	50	1	0

APPENDIX D.2

Sample Output

```
FILE NAME L2R47                    NO. OF CHANNELS =     4
TIME INCREMENT,SEC =   .12500E-04 NO. OF DATA SUBSETS =    25

DATA CHANNEL
   3   15   16   16   16   18   50    1    0
NTS = L2R47                 1 1 4                  NPT =     4588 START TIME =   0.        DT =   .12500E-04
    2121.     2123.     2126.     2130.     2134.     2130.     2130.     2139.     2133.     2133.
    2142.     2140.     2141.     2152.     2150.     2146.     2151.     2152.     2149.     2157.
NTS = L2R47                 1 2 4                  NPT =     4588 START TIME =   0.        DT =   .12500E-04
    2036.     2036.     2032.     2039.     2047.     2039.     2033.     2036.     2042.     2033.
    2036.     2043.     2030.     2030.     2030.     2041.     2033.     2043.     2043.     2041.
NTS = L2R47                 1 3 4                  NPT =     4588 START TIME =   0.        DT =   .12500E-04
    2624.     2613.     2626.     2628.     2651.     2632.     2644.     2646.     2651.     2653.
    2679.     2690.     2678.     2669.     2700.     2693.     2680.     2689.     2676.     2691.
NTS = L2R47                 1 4 4                  NPT =     4588 START TIME =   0.        DT =   .12500E-04
    2433.     2443.     2427.     2440.     2445.     2453.     2456.     2462.     2482.     2496.
    2499.     2502.     2507.     2517.     2518.     2535.     2513.     2527.     2529.     2531.

FILE NAME DP47                     NO. OF CHANNELS =     1
TIME INCREMENT,SEC =   .12500E-04 NO. OF DATA SUBSETS =    28

DATA CHANNEL
   4    5    5    6    6   27   50    2    0
NTS = DP47                  2 1 1                  NPT =    22569 START TIME =   0.        DT =   .25000E-04
    2036.     2029.     2046.     2030.     2029.     2038.     2044.     2032.     2047.     2033.
    2030.     2045.     2033.     2045.     2038.     2036.     2041.     2035.     2041.     2033.

FILE NAME L2R46                    NO. OF CHANNELS =     4
TIME INCREMENT,SEC =   .12500E-04 NO. OF DATA SUBSETS =    25

DATA CHANNEL
   2   13   14   14   14   18   50    1    0
NTS = L2R46                 3 1 4                  NPT =     8643 START TIME =   0.        DT =   .12500E-04
    2011.     2007.     2019.     2016.     2004.     2017.     2001.     2015.     2009.     2006.
    2004.     2011.     2004.     2001.     2006.     2016.     2013.     2009.     2010.     2029.
NTS = L2R46                 3 2 4                  NPT =     8643 START TIME =   0.        DT =   .12500E-04
    2350.     2336.     2328.     2336.     2338.     2358.     2346.     2351.     2352.     2350.
    2340.     2350.     2342.     2352.     2336.     2341.     2337.     2344.     2329.     2318.
NTS = L2R46                 3 3 4                  NPT =     8643 START TIME =   0.        DT =   .12500E-04
    2965.     2978.     2978.     2980.     2973.     2991.     2972.     2967.     2972.     2966.
    2974.     2971.     2957.     2969.     2976.     2976.     2989.     2984.     2973.     2985.
NTS = L2R46                 3 4 4                  NPT =     8643 START TIME =   0.        DT =   .12500E-04
    2845.     2833.     2856.     2849.     2830.     2850.     2815.     2839.     2835.     2817.
    2839.     2817.     2843.     2817.     2833.     2837.     2832.     2864.     2847.     2851.
```


L2R47
ID 1 PLOT
TIME, MS
/FRAME= 57.350
/TIC- 6.250
5000
4000
3000
2000
1000
0
0
500
1000
1500
2000
2500
3000
3500
4000

APPENDIX E

IMPLEMENTATION OF STEP 4

APPENDIX E.1

Listing of MFA File ADTAPE4/UN=BOOTS

APPENDIX E.1

Listing of MFA File ADTAPE4/UN=BOOTS

a. Job Control Language

```
BOOTS,STMFZ,P6,MS300000.
ACCOUNT,PDxxx.
REQUEST,NEWPL,*PF.
REQUEST,BIN,*PF.
BEGIN,ATTACH,PLOTLIB.
ATTACH,OLDPL,ADENGR,ID=BOOTS.
UPDATE,F,N.
FTN,I=COMPILE,L=0.
ATTACH,TAPE1,LOLAED,ID=BOOTS.
LGO.
EXIT,U.
BEGIN,PLOT,CALCOMP,TAPE13.
*EOR
```

b. UPDATE Corrections

```
*IDENT HPAD1
*EOR
```

c. Input Card Images

```
  14        1.       1000         .0    0    1
 $CONVAR NX=50,NY(1)=500,NY(2)=70,NY(3)=150,NY(4)=230,NY(5)=320,
 NY(6)=400,ITZ=1000,IBSE=3700$
```

APPENDIX E.2

Listing of MFZ File ADENGR,ID=BOOTS

```
      PROGRAM DATA (INPUT,OUTPUT,TEMP,TAPE1,TAPE2=TEMP,TAPE5=INPUT,      MAIN      8
     1TAPE6=OUTPUT,TAPE13,TAPE3,TAPE4)                                   C19       2
C                                                                        MAIN      4
C     FOR THIS PROGRAM BROAD HAS BEEN MODIFIED SO THAT                   HPAD      7
C     THE ENTIRE DATA SET IS READ IN AT ONE TIME;                        HPAD      8
C     N CANNOT EXCEED 23000;                                             HPAD      9
C     SINGLE INTEGRATION CAN BE DONE ON THE ENTIRE DATA SET,             HPAD     10
C     DOUBLE INTEGRATION CAN BE DONE IF N DOES NOT EXCEED 12500.         HPAD     11
C                                                                        HPAD     12
      COMMON R(25000),T(23000),P(23000),NOS,LP,LABEL(4),NY(6),Y(6),IQ(5) HPAD4     1
     1 ,SBL,I,TZ,JP,IX,DELT,IDZ,MOP(10),LLC,B,SA,SB,DTIME,NJ(10),TSTART, HPAD      3
     2  SC, SKP, XAX, XFAC, YFAC, TIT(30), ISU, KP, YB, XB, NTS(24),ITZ, COM       4
     3 JPI(50),IZ,ITM,NOSR,N,IPNO(5),SS,KST51,KST52,YAX,JSU,KU           HPAD      4
      DIMENSION PI(1),PI2(1)                                             HPAD      5
      EQUIVALENCE (R(1),PI(1)),(R(12501),PI2(1))                         HPAD      6
      DIMENSION S(3), RV(6), AF(6), SIG(3), TG(6),          X(6), EQ(6,  MAIN      6
     1  3), F(3,4), SX(6)                                               MAIN      7
      NAMELIST/CONVAR/SKP,XAX,YAX,XFAC,YFAC,ITM,NX,NY,MOP,SS,ITZ,NS,IBSE HPAD4     2
      LABEL(1)=10H BOOTS                                                 C2        3
      LABEL(2)=10H390 6121                                               HPAD3     1
      LABEL(3)=10H A/D DATA                                              HPAD     13
      LABEL(4)=10HREDUCTION                                              C3        2
      WRITE(6,800)                                                       C1        1
      TIT(26)= 1HD                                                       MAIN      9
      ITM=23000                                                          HPAD3     2
      ITZ= 950                                                           MAIN     11
      LLCS= 1                                                            MAIN     12
      MOP(1)= 1                                                          MAIN     13
      MOP(2)= 3                                                          MAIN     14
      MOP(5)= 0                                                          MAIN     15
      NX=40                                                              MAIN     16
      NY(1)=16                                                           MAIN     17
      NY(2)=100                                                          MAIN     18
      NY(3)=240                                                          MAIN     19
      NY(4)=360                                                          MAIN     20
      NY(5)=480                                                          MAIN     21
      NY(6)=600                                                          MAIN     22
      SKP=150.                                                           MAIN     23
      SS= 1.                                                             MAIN     24
      XAX=7.5                                                            C3        3
      XFAC= 1.                                                           MAIN     26
      YAX= 5.                                                            MAIN     27
      YFAC= 1.                                                           MAIN     28
      NS=6                                                               CAL2      2
      IBSE=500                                                           CAL4      2
C                                                                        MAIN     29
CC                                                                       MAIN     30
CC       READING DATA                                                    MAIN     31
C                                                                        MAIN     32
      XB=2.                                                              C3        4
      YB=1.5                                                             C3        5
      KST51=0                                                            MAIN     35
      KST52=0                                                            MAIN     36
   20 IF(NLK.GT.0)GO TO 21                                               HPAD2     1
      READ(5,700)IPNO(2),IPNO(3),B,IXS,DLTM,IDZS,NLIST,IFID,NLK          HPAD2     2
      IF (EOF(5) .NE. 0.) STOP                                           MAIN     38
      IF (NLIST .NE. 0) READ(5,CONVAR)                                   MAIN     39
```

```
   21 NLK=NLK-1                                                          HPAD2     3
      DO 25 KT=1,10                                                      C19       3
   25 NJ(KT)=0                                                           C19       4
C                                                                        MAIN      40
CC      INTERPRETING OPTIONS FROM 3-DIGIT CODE                           MAIN      41
C                                                                        MAIN      42
      IF(IPNO(2).EQ.0.AND.IPNO(3).EQ.0)GO TO 660                         HPAD      15
      II=2                                                               HPAD      16
      IF (IPNO(II).NE.1) GO TO 120                                       MAIN      81
      IDZ=1                                                              MAIN      82
      IX=500                                                             MAIN      83
      GO TO 200                                                          MAIN      84
  120 IF (IPNO(II).NE.2) GO TO 130                                       MAIN      85
      IDZ=1                                                              MAIN      86
      IX=2000                                                            MAIN      87
      GO TO 200                                                          MAIN      88
  130 IF (IPNO(II).NE.3) GO TO 140                                       MAIN      89
      IDZ=1                                                              MAIN      90
      IX=3000                                                            MAIN      91
      GO TO 200                                                          MAIN      92
  140 IF (IPNO(II).NE.4) GO TO 150                                       MAIN      93
      IDZ=3                                                              MAIN      94
      IX=500                                                             MAIN      95
      GO TO 200                                                          MAIN      96
  150 IF (IPNO(II).NE.5) GO TO 160                                       MAIN      97
      IDZ=3                                                              MAIN      98
      IX=2000                                                            MAIN      99
      GO TO 200                                                          MAIN      100
  160 IF (IPNO(II).NE.6) GO TO 170                                       MAIN      101
      IDZ=3                                                              MAIN      102
      IX=3000                                                            MAIN      103
      GO TO 200                                                          MAIN      104
  170 IF (IPNO(II).NE.7) GO TO 180                                       MAIN      105
      IDZ=5                                                              MAIN      106
      IX=500                                                             MAIN      107
      GO TO 200                                                          MAIN      108
  180 IF (IPNO(II).NE.8) GO TO 190                                       MAIN      109
      IDZ=5                                                              MAIN      110
      IX=2000                                                            MAIN      111
      GO TO 200                                                          MAIN      112
  190 IF (IPNO(II).NE.9) GO TO 670                                       MAIN      113
      IDZ=5                                                              MAIN      114
      IX=3000                                                            MAIN      115
  200 II=3                                                               MAIN      116
      IF (IPNO(II).NE.1) GO TO 210                                       MAIN      117
      KP=0                                                               MAIN      118
      MOP(3)=0                                                           MAIN      119
      MOP(4)=0                                                           MAIN      120
      GO TO 290                                                          MAIN      121
  210 IF (IPNO(II).NE.2) GO TO 220                                       MAIN      122
      KP=0                                                               MAIN      123
      MOP(3)=2                                                           MAIN      124
      MOP(4)=0                                                           MAIN      125
      GO TO 290                                                          MAIN      126
  220 IF (IPNO(II).NE.3) GO TO 230                                       MAIN      127
      KP=0                                                               MAIN      128
      MOP(3)=2                                                           MAIN      129
```

```
115               MOP(4)=2                                                  MAIN      130
                  GO TO 290                                                 MAIN      131
              230 IF (IPNO(II).NE.4) GO TO 240                              MAIN      132
                  KP=2                                                      MAIN      133
                  MOP(3)=0                                                  MAIN      134
120               MOP(4)=0                                                  MAIN      135
                  GO TO 290                                                 MAIN      136
              240 IF (IPNO(II).NE.5) GO TO 250                              MAIN      137
                  KP=2                                                      MAIN      138
                  MOP(3)=2                                                  MAIN      139
125               MOP(4)=0                                                  MAIN      140
                  GO TO 290                                                 MAIN      141
              250 IF (IPNO(II).NE.6) GO TO 260                              MAIN      142
                  KP=2                                                      MAIN      143
                  MOP(3)=2                                                  MAIN      144
130               MOP(4)=2                                                  MAIN      145
                  GO TO 290                                                 MAIN      146
              260 IF (IPNO(II).NE.7) GO TO 270                              MAIN      147
                  KP=1                                                      MAIN      148
                  MOP(3)=0                                                  MAIN      149
135               MOP(4)=0                                                  MAIN      150
                  GO TO 290                                                 MAIN      151
              270 IF (IPNO(II).NE.8) GO TO 280                              MAIN      152
                  KP=1                                                      MAIN      153
                  MOP(3)=2                                                  MAIN      154
140               MOP(4)=0                                                  MAIN      155
                  GO TO 290                                                 MAIN      156
              280 IF (IPNO(II).NE.9) GO TO 670                              MAIN      157
                  KP=1                                                      MAIN      158
                  MOP(3)=2                                                  MAIN      159
145               MOP(4)=2                                                  MAIN      160
                  GO TO 290                                                 MAIN      161
              290 IF (IXS.NE.0) IX=IXS                                      MAIN      162
                  IF (IDZS.NE.0) IDZ=IDZS                                   MAIN      164
                  KU=0                                                      MAIN      165
150               ISW=0                                                     MAIN      167
                  JSW=0                                                     MAIN      168
            C                                                               MAIN      169
            C     READING FROM TAPE                                         MAIN      170
            C                                                               MAIN      171
155               NOS=1                                                     HPAD       17
                  NOSR=0                                                    HPAD       18
                  N=1                                                       HPAD       19
                  IZ=0                                                      C19         5
                  DO 640 LP=1,NOS                                           MAIN      178
160               LLC=LLCS                                                  MAIN      179
                  IF (KU.EQ.0) I=3                                          MAIN      180
                  CALL DATAIN                                               HPAD       21
                  TZ=DELT*1000.*FLOAT(IX)-DLTM+TSTART                       HPAD       22
                  DTIME=FLOAT(IDZ)*DELT*1000.                               HPAD       23
165               J=1                                                       MAIN      194
                  IF (KU.EQ.10) GO TO 540                                   MAIN      195
                  IF (LP.GT.1) GO TO 560                                    MAIN      196
                  WRITE(6,710)(NTS(K),K=1,12)                               HPAD       24
            C                                                               MAIN      198
170         C       PREDICT METHOD OF CALCULATING CALIBRATION STEPS         MAIN      199
            C                                                               MAIN      200
```

```
      350 SUM=0.                                                          MAIN      201
          I=NY(J)                                                         MAIN      202
          IPP=1                                                           MAIN      203
          ICK=1                                                           MAIN      204
175       SUMM=0.                                                         MAIN      205
      360 IF (ABS(R(I)-R(I-1)).LT.SKP) GO TO 400                          MAIN      206
          IF (ABS(R(I)-R(I-2)).LT.SKP) GO TO 390                          MAIN      207
          IF (ABS(R(I+1)-R(I-1)).GT.SKP) GO TO 370                        MAIN      208
          GO TO 390                                                       MAIN      209
180   370 IF (ABS(R(I+2)-R(I-1)).GT.SKP) GO TO 380                        MAIN      210
          I=I+2                                                           MAIN      211
          GO TO 400                                                       MAIN      212
      380 IF (ICK.GE.10) GO TO 650                                        MAIN      213
          ICK=ICK+1                                                       MAIN      214
185       I=I+3                                                           MAIN      215
          GO TO 360                                                       MAIN      216
      390 I=I+1                                                           MAIN      217
      400 SUM=SUM+R(I)                                                    MAIN      218
          SUMM=SUMM+R(I)**2                                               MAIN      219
190       IPP=IPP+1                                                       MAIN      220
          I=I+1                                                           MAIN      221
          IF (IPP.EQ.NX+1) GO TO 410                                      MAIN      222
          GO TO 360                                                       MAIN      223
195   410 X(J)=SUM/FLOAT(NX)                                              MAIN      224
          SX(J)=SQRT(SUMM/FLOAT(NX)-(X(J)**2))                            MAIN      225
          IF(J.EQ.NS) GO TO 420                                           CAL2        3
          J=J+1                                                           MAIN      227
          GO TO 350                                                       MAIN      228
200   C                                                                   MAIN      229
      C       FORMING EQUATIONS AND GENLSQ                                MAIN      230
      C                                                                   MAIN      231
      420 Y(1)=0.                                                         MAIN      232
          Y(2)=1.*SS                                                      MAIN      233
205       Y(3)=2.*SS                                                      MAIN      234
          Y(4)=3.*SS                                                      MAIN      235
          Y(5)=4.*SS                                                      MAIN      236
          Y(6)=5.*SS                                                      MAIN      237
          SBL=X(1)                                                        MAIN      238
210       WRITE(6,720) (X(M),M=1,NS),(SX(M),M=1,NS)                       CAL2        4
          DO 430 M=1,NS                                                   CAL2        5
      430 X(M)=X(M)-SBL                                                   MAIN      241
          DO 440 L=1,6                                                    MAIN      242
          EQ(L,1)=1.                                                      MAIN      243
215       EQ(L,2)=X(L)                                                    MAIN      244
      440 EQ(L,3)=X(L)**2                                                 MAIN      245
          WRITE (6,730)                                                   MAIN      246
          DO 450 L=1,NS                                                   CAL2        6
      450 WRITE (6,740) EQ(L,1),EQ(L,2),EQ(L,3),Y(L)                      MAIN      248
220       IF (ABS(X(1)-X(2)).LE.20.) GO TO 460                            MAIN      249
          CALL GENLSQ (EQ,6,Y,NS,F,3,3,S,RV,AF,ERMS,SIG,TG,DET,0)         MAIN      251
          SA=S(1)                                                         MAIN      252
          SB=S(2)                                                         MAIN      253
          SC=S(3)                                                         MAIN      254
225       GO TO 470                                                       MAIN      255
      460 SA=0.                                                           MAIN      256
          SB=1.                                                           MAIN      257
          SC=0.                                                           MAIN      258
```

```
                B=1.                                                                MAIN      259
230             SIG(1)=0.0                                                          MAIN      260
                SIG(2)=0.0                                                          MAIN      261
                SIG(3)=0.0                                                          MAIN      262
              470 WRITE (6,750)                                                     MAIN      263
                  WRITE(6,760)NTS(10),NTS(11),NTS(12),B,SA,SB,SC,SIG(1),SIG(2),     HPAD       25
235              * SIG(3)                                                           HPAD       26
C                                                                                   MAIN      265
C                  SEARCHING FOR FIDUCIAL                                           MAIN      266
C                                                                                   MAIN      267
                I=I+ITZ                                                             MAIN      268
240             IF(IFID.NE.0)GO TO 525                                              HPAD       27
              480 IF (ABS(R(I)-R(I-1)).LT.SKP) GO TO 500                            MAIN      269
                  IF (ABS(R(I)-R(I-2)).LT.SKP) GO TO 500                            MAIN      270
                  IF (ABS(R(I+1)-R(I-1)).GT.SKP) GO TO 490                          MAIN      271
                  GO TO 510                                                         MAIN      272
245           490 IF (ABS(R(I+2)-R(I-1)).GT.SKP) GO TO 520                          MAIN      273
                  I=I+3                                                             MAIN      274
                  GO TO 480                                                         MAIN      275
              500 I=I+1                                                             MAIN      276
                  GO TO 480                                                         MAIN      277
250           510 I=I+2                                                             MAIN      278
                  GO TO 480                                                         MAIN      279
              520 WRITE (6,770) I                                                   MAIN      280
              525 SUM=.0                                                            HPAD       28
                  IFS=I+IBSE                                                        CAL4        3
255               DO 530 KF=1,100                                                   MAIN      283
                  SUM=SUM+R(IFS)                                                    MAIN      284
                  IFS=IFS+1                                                         MAIN      285
              530 CONTINUE                                                          MAIN      286
                  SBL=SUM/100.                                                      MAIN      287
260               WRITE (6,780) SBL                                                 MAIN      288
                  I=I+IX                                                            MAIN      289
              540 IF(I.LT.JP)GO TO 560                                              HPAD1       1
                  JPI(LP)=0                                                         MAIN      291
                  KU=10                                                             MAIN      292
265               GO TO 680                                                         HPAD1       2
C                                                                                   MAIN      296
C                  CALLING SUBROUTINES                                              MAIN      297
C                                                                                   MAIN      298
              560 MIP=MOP(LLC)                                                      MAIN      299
270               IF (MIP.EQ.0) GO TO 630                                           MAIN      300
                  GO TO (580,590,570), MIP                                          MAIN      301
              570 IF (KP.EQ.0) GO TO 620                                            MAIN      302
                  GO TO (600,610), KP                                               MAIN      303
              580 CALL PRESS                                                        MAIN      304
275               LLC=LLC+1                                                         MAIN      305
                  GO TO 560                                                         MAIN      306
              590 CALL INTG                                                         MAIN      307
                  LLC=LLC+1                                                         MAIN      308
                  GO TO 560                                                         MAIN      309
280           600 WRITE(6,601)                                                      HPAD       29
              601 FORMAT(' THE DECK PLOT1 HAS BEEN YANKED')                         HPAD       30
                  LLC=LLC+1                                                         MAIN      311
                  GO TO 560                                                         MAIN      312
              610 ISW=ISW+1                                                         MAIN      313
285               CALL PLOT2                                                        MAIN      314
```

```
      620 LLC=LLC+1                                                          MAIN      315
          GO TO 560                                                          MAIN      316
      630 KU=0                                                               MAIN      317
      640 CONTINUE                                                           MAIN      318
290       CALL DATAS(KN)                                                     HPAD       31
          WRITE(6,790)NTS(10),NTS(11),NTS(12),KN                             HPAD       32
          WRITE (6,800)                                                      MAIN      320
          REWIND 2                                                           HPAD       33
          REWIND 4                                                           C21         1
295       GO TO 80                                                           MAIN      322
C                                                                            MAIN      323
C         ERROR PRINTS                                                       MAIN      324
C                                                                            MAIN      325
      650 WRITE (6,810) R(I),R(I+1),R(I+2)                                   MAIN      326
300       STOP                                                               MAIN      327
      660 READ (5,820) IQ                                                    MAIN      328
          CALL SKIP                                                          HPAD4       3
          GO TO 20                                                           MAIN      330
      670 WRITE (6,830) II,IPNO(II)                                          MAIN      331
305       STOP                                                               MAIN      332
      680 WRITE(6,840)I,JP                                                   HPAD1       3
          GO TO 20                                                           HPAD1       4
C                                                                            MAIN      333
      700 FORMAT(3X,2I1,F10.3,I10,F10.0,9I5)                                 HPAD       35
310   710 FORMAT(///,4H ID=,12A2)                                            HPAD4       4
      720 FORMAT (6H X'S  ,6(F10.3,2X) / 5X, 6(F10.3, 2X))                   MAIN      336
      730 FORMAT (1H0,26X,18HORIGINAL EQUATIONS)                             MAIN      337
      740 FORMAT (1H ,4(E15.8,2X))                                           MAIN      338
      750 FORMAT (1H0,27HCHANNEL GAGE CALIB CONSTANT,6X,2HSA,11X,2HSB,11X,2H MAIN      339
315     1SC,9X,6HSIG(1),7X,6HSIG(2),7X,6HSIG(3))                             MAIN      340
      760 FORMAT(2X,3A2,3X,F12.4,5X,6(E12.5,1X))                             HPAD       37
      770 FORMAT (1H0,19HINDEX TO FIDUCIAL =,I10)                            MAIN      342
      780 FORMAT ('0BASELINE AVERAGE = ',F9.2)                               MAIN      343
      790 FORMAT(1H ,27HTHIS IS THE END OF CHANNEL ,3A2,' - ',I10,           HPAD       38
320     x' DATA POINTS SAVED')                                               HPAD       39
      800 FORMAT (1H1)                                                       MAIN      345
      810 FORMAT (1H ,36HTHERE IS A LOT OF SOMETHING GOING ON,3X,3(F10.3,3X) MAIN      346
         1)                                                                  MAIN      347
      820 FORMAT (I5)                                                        MAIN      348
325   830 FORMAT (31H0THIS OPTION IS INCORRECT, II =,I5,3X,3X,8HOPTION =,I5) MAIN      349
      840 FORMAT(' I.GE.JP, I = ',I10,'   JP = ',I10)                        HPAD1       5
          END                                                                MAIN      350
```

```
      SUBROUTINE DATAF                                                  DATAF     2
      COMMON R(25000),T(23000),P(23000),NOS,LP,LABEL(4),NY(6),Y(6),IQ(5) HPAD4     1
     1 ,SBL,I,TZ,JP,IX,DELT,IDZ,MOP(10),LLC,B,SA,SB,DTIME,NJ(10),TSTART, HPAD      3
     2  SC, SKP, XAX, XFAC, YFAC, TIT(30), ISW, KP, YB, XB, NTS(24),ITZ, COM      4
     3 JPI(50),IZ,ITM,NOSR,N,IPNO(5),SS,KSTS1,KSTS2,YAX,JSW,KU          HPAD      4
      DIMENSION PI(1),PI2(1)                                            HPAD      5
      EQUIVALENCE (R(1),PI(1)),(R(12501),PI2(1))                        HPAD      6
      IF(JSW.EQ.1)GO TO 20                                              C19       7
      WRITE(4)NTS                                                       C19       8
      WRITE(4)T(1),DTIME                                                C19       9
      WRITE(4)N                                                         C19      10
      WRITE(4)(P(IT),IT=1,N)                                            C19      11
      NJ(LP)=N                                                          C20       1
      GO TO 30                                                          C19      13
   20 NJ(LP)=0                                                          C19      14
   30 RETURN                                                            C19      15
      END                                                               DATAF    11
```



```
C                                                                       HPAD      40
      SUBROUTINE DATAIN                                                 HPAD      41
C                                                                       HPAD      42
      COMMON R(25000),T(23000),P(23000),NOS,LP,LABEL(4),NY(6),Y(6),IQ(5) HPAD4     1
     1 ,SBL,I,TZ,JP,IX,DELT,IDZ,MOP(10),LLC,B,SA,SB,DTIME,NJ(10),TSTART, HPAD      3
     2  SC, SKP, XAX, XFAC, YFAC, TIT(30), ISW, KP, YB, XB, NTS(24),ITZ, COM      4
     3 JPI(50),IZ,ITM,NOSR,N,IPNO(5),SS,KSTS1,KSTS2,YAX,JSW,KU          HPAD      4
      DIMENSION PI(1),PI2(1)                                            HPAD      5
      EQUIVALENCE (R(1),PI(1)),(R(12501),PI2(1))                        HPAD      6
      READ(1)NTS                                                        HPAD      44
      IF(EOF(1).NE..0)STOP                                              HPAD      45
      READ(1)JP                                                         HPAD      46
      WRITE(6,1)NTS,JP                                                  HPAD      47
      READ(1)TSTART,DELT                                                HPAD      48
      READ(1)(R(I),I=1,JP)                                              HPAD      49
      RETURN                                                            HPAD      50
    1 FORMAT(1H0,1X,24A2,I10)                                           HPAD      51
      END                                                               HPAD      52
```

```
      SUBROUTINE DATAS(KN)                                                    HPAD      53
      DIMENSION NTSD(24)                                                      DATAS      3
      COMMON R(25000),T(23000),P(23000),NOS,LP,LABEL(4),MY(6),V(6),IQ(5)      HPAD4      1
     1 ,SBL,I,TZ,JP,IX,DELT,IDZ,MOP(10),LLC,B,SA,SB,DTIME,NJ(10),TSTART,      HPAD       3
     2  SC, SKP, XAX, XFAC, YFAC, TIT(30), ISW, KP, YB, XB, NTS(24),ITZ,      COM        4
     3 JPI(50),IZ,ITM,NOSR,N,IPNO(5),SS,KSTS1,KSTS2,YAX,JSW,KU                HPAD       4
      DIMENSION PI(1),PI2(1)                                                  HPAD       5
      EQUIVALENCE (R(1),PI(1)),(R(12501),PI2(1))                              HPAD       6
      JT=0                                                                    DATAS      5
      KN=0                                                                    DATAS      6
      NSW=1                                                                   DATAS      7
      REWIND 4                                                                DATAS      8
      IF(JSW.EQ.1)GO TO 10                                                    DATAS      9
      NOS1=NOS                                                                DATAS     10
      GO TO 20                                                                DATAS     11
   10 NOS1=NOS-1                                                              DATAS     12
   20 DO 60 IJ=1,NOS1                                                         DATAS     13
      IF(NJ(IJ).EQ.0)GO TO 50                                                 DATAS     14
      IF(NSW.GT.1)GO TO 30                                                    DATAS     15
      NSW=2                                                                   DATAS     16
      READ(4)NTS                                                              DATAS     17
      READ(4)TT,DTIME                                                         DATAS     18
      GO TO 40                                                                DATAS     19
   30 READ(4)NTSD                                                             DATAS     20
      READ(4)TTD,DTD                                                          DATAS     21
   40 JIP=JT+NJ(IJ)                                                           DATAS     22
      JT=JT+1                                                                 DATAS     23
      READ(4)N                                                                DATAS     24
      READ(4) (P(IU),IU=JT,JIP)                                               DATAS     25
      JT=JIP                                                                  DATAS     26
   50 KN=KN+NJ(IJ)                                                            DATAS     27
   60 CONTINUE                                                                DATAS     28
      WRITE(3)NTS                                                             DATAS     29
      WRITE(3)KN                                                              DATAS     31
      WRITE(3)TT,DTIME                                                        C20        2
      WRITE(3)(P(IU),IU=1,KN)                                                 DATAS     32
      RETURN                                                                  DATAS     33
      END                                                                     DATAS     34
```

```
      C                                                                      PRESS     2
            SUBROUTINE PRESS                                                 PRESS     3
      C                                                                      PRESS     4
            COMMON R(25000),T(23000),P(23000),NOS,LP,LABEL(4),MY(6),Y(6),IQ(5) HPAD4    1
           1 ,SBL,I,TZ,JP,IX,DELT,IDZ,MOP(10),LLC,B,SA,SB,DTIME,NJ(10),TSTART, HPAD     3
           2  SC, SKP, XAX, XFAC, YFAC, TIT(30), ISU, KP, YB, XB, NTS(24),ITZ, COM      4
           3 JPI(50),IZ,ITM,NOSR,N,IPNO(5),SS,KSTS1,KSTS2,YAX,JSU,KU           HPAD     4
            DIMENSION PI(1),PI2(1)                                           HPAD      5
            EQUIVALENCE (R(1),PI(1)),(R(12501),PI2(1))                       HPAD      6
      C                                                                      PRESS    11
      C     CALCULATING PRESSURE                                             PRESS    12
      C                                                                      PRESS    13
            N=1                                                              HPAD     54
            IZ=IZ+1                                                          C19      16
            IF (IZ.GE.ITM) GO TO 80                                          PRESS    15
         30 P(N)=R(I)                                                        PRESS    16
            CF=SA+SB*(P(N)-SBL)+SC*(P(N)-SBL)**2                             PRESS    17
            P(N)=B*CF                                                        PRESS    18
            T(N)=TZ+FLOAT(IZ)*DTIME                                          C17      3
            IF (IZ.GE.ITM) GO TO 40                                          PRESS    20
            IF (I+IDZ.GT.JP) GO TO 40                                        PRESS    21
            N=N+1                                                            PRESS    22
            I=I+IDZ                                                          PRESS    23
            IZ=IZ+1                                                          PRESS    24
            GO TO 30                                                         PRESS    25
         40 IF (MOP(3).NE.0) GO TO 90                                        PRESS    26
            IF (LP.GT.1) GO TO 50                                            PRESS    27
      C                                                                      PRESS    28
      C       PRINTING PRESSURE                                              PRESS    29
      C                                                                      PRESS    30
            WRITE(6,100)DTIME                                                HPAD     55
         50 DO 55 ML=1,N,15                                                  C9       1
            MLM=ML+14                                                        C10      1
            IF(MLM.GT.N)MLM=N                                                C19      17
            WRITE(6,110)T(ML),(P(MK),MK=ML,MLM)                              C9       3
         55 CONTINUE                                                         C9       4
            CALL DATAF                                                       C12      6
      C                                                                      PRESS    33
      C      ERROR PRINT                                                     PRESS    34
      C                                                                      PRESS    35
            IF (I.GT.JP.AND.LP.EQ.NOS) GO TO 60                              PRESS    36
            GO TO 90                                                         C19      18
         60 WRITE (6,120) I,JP,N                                             PRESS    38
            GO TO 90                                                         PRESS    41
         80 JSU=1                                                            PRESS    42
            N=0                                                              PRESS    43
         90 RETURN                                                           PRESS    44
      C                                                                      PRESS    45
        100 FORMAT(1H0,48H TIME AND DATA POINTS SAVED - TIME INTERVAL, MS=,   HPAD     56
           * F8.6)                                                           HPAD     57
        110 FORMAT(1X,F10.4,15F8.2)                                          CAL3     1
        120 FORMAT (1H0,//,25HI IS GREATER THAN JP, I =,I10,3X,4HJP =,I10,3HN PRESS    48
           1=,I10)                                                           PRESS    49
            END                                                              PRESS    51
```

```
      C                                                                                 INTG     2
            SUBROUTINE INTG                                                             INTG     3
      C                                                                                 INTG     4
            COMMON R(25000),T(23000),P(23000),NOS,LP,LABEL(4),NY(6),Y(6),IQ(5)          HPAD4    1
           1 ,SBL,I,TZ,JP,IX,DELT,IDZ,MOP(10),LLC,B,SA,SB,DTIME,NJ(10),TSTART,          HPAD     3
           2  SC,  SKP,  XAX,  XFAC,  YFAC,  TIT(30),  ISW,  KP,  YB,  XB,  NTS(24),ITZ,  COM      4
           3 JPI(50),IZ,ITH,NOSR,N,IPNO(5),SS,KSTS1,KSTS2,YAX,JSW,KU                    HPAD     4
            DIMENSION PI(1),PI2(1)                                                      HPAD     5
            EQUIVALENCE (R(1),PI(1)),(R(12501),PI2(1))                                  HPAD     6
            IF (JSW.EQ.1) GO TO 60                                                      INTG     6
            IF (LLC.EQ.4.AND.MOP(4).EQ.2) GO TO 30                                      INTG     7
            IF (LP.GT.1.AND.KU.EQ.0) GO TO 10                                           INTG     8
            PI(1)=0.0                                                                   INTG     9
            IF (MOP(4).EQ.2) GO TO 10                                                   INTG    10
            WRITE (6,70)                                                                INTG    11
      C                                                                                 INTG    12
      C       CALCULATION  OF FIRST INTEGRAL                                            INTG    13
      C                                                                                 INTG    14
         10 DELP=DELT*FLOAT(IDZ)/1000.                                                  INTG    15
            DO 20 IT=2,N                                                                INTG    16
         20 PI(IT)=PI(IT-1)+.5*DELP*(P(IT-1)+P(IT))                                     INTG    17
            IF (MOP(4).EQ.2) GO TO 60                                                   INTG    18
      C                                                                                 INTG    19
      C       PRINT OF FIRST INTEGRAL                                                   INTG    20
      C                                                                                 INTG    21
            WRITE(6,80)(T(IT),P(IT),PI(IT),IT=1,N)                                      C5       2
            PI(1)=PI(N)                                                                 INTG    23
            GO TO 60                                                                    INTG    24
      C                                                                                 INTG    25
      C       CALCULATION OF SECOND INTEGRAL                                            INTG    26
      C                                                                                 INTG    27
         30 IF (LP.GT.1.AND.KU.EQ.0) GO TO 40                                           INTG    28
            WRITE (6,90)                                                                INTG    29
            PI2(1)=0.                                                                   INTG    30
         40 DELP=DELT*FLOAT(IDZ)/1000.                                                  INTG    31
            DO 50 IT=2,N                                                                INTG    32
         50 PI2(IT)=PI2(IT-1)+.5*DELP*(PI(IT-1)+PI(IT))                                 INTG    33
      C                                                                                 INTG    34
      C     PRINT OF FIRST AND SECOND INTEGRAL                                          INTG    35
      C                                                                                 INTG    36
            WRITE(6,100)(T(IT),P(IT),PI(IT),PI2(IT),IT=1,N)                             C5       3
            PI2(1)=PI2(N)                                                               INTG    38
            PI(1)=PI(N)                                                                 INTG    39
         60 RETURN                                                                      INTG    40
      C                                                                                 INTG    41
         70 FORMAT (1H1,5X,2(4HTIME,10X,8HPRESSURE,8X,8HINTEGRAL,10X))                  INTG    42
         80 FORMAT (1H ,6(F13.6,3X))                                                    INTG    43
         90 FORMAT (1H1,5X,4HTIME,10X,8HPRESSURE,8X,8HINTEGRAL,8X,8HINTEGRAL,1         INTG    44
           10X,4HTIME,10X,8HPRESSURE,8X,8HINTEGRAL,8X,8HINTEGRAL)                       INTG    45
        100 FORMAT (1H ,8(F13.6,3X))                                                    INTG    46
            END                                                                         INTG    47
```

```
      C                                                                       PLOT2      2
            SUBROUTINE PLOT2                                                  PLOT2      3
      C                                                                       PLOT2      4
            COMMON R(25000),T(23000),P(23000),NOS,LP,LABEL(4),NY(6),Y(6),IQ(5) HPAD4      1
           1 ,SBL,I,TZ,JP,IX,DELT,IDZ,MOP(10),LLC,B,SA,SB,DTIME,NJ(10),TSTART, HPAD      3
           2  SC, SKP, XAX, XFAC, YFAC, TIT(30), ISW, KP, YB, XB, NTS(24),ITZ, COM       4
           3 JPI(50),IZ,ITM,NOSR,N,IPNO(5),SS,KSTS1,KSTS2,YAX,JSW,KU          HPAD      4
            DIMENSION PI(1),PI2(1)                                            HPAD      5
            EQUIVALENCE (R(1),PI(1)),(R(12501),PI2(1))                        HPAD      6
      C                                                                       PLOT2      7
      CC     THIS SUBROUTINE PLOTS REGULAR PLOTS                              PLOT2      8
      C                                                                       PLOT2      9
            IF (ISW.GT.1) GO TO 10                                            PLOT2     10
            ISW=ISW+1                                                         PLOT2     11
            XPAGE=XAX+3.5                                                     C3         6
            YPAGE=YAX+3.5                                                     C3         7
            CALL PLTBEG(XPAGE,YPAGE,1.,13,LABEL)                              C2        16
         10 KN=N                                                              HPAD      58
            CALL FIXSCA (P(1),KN,YAX,YS,YMI,YMA,DY)                           PLOT2     37
            CALL FIXSCA (T(1),KN,XAX,XS,XMI,XMA,DX)                           PLOT2     38
            CALL PLTSCA(XB,YB,XMI,YMI,XS,YS)                                  C2        17
            CALL PLTAXS(DX,DY,XMI,XMA,YMI,YMA,4)                              C2        18
            TX=XMI-1.5*XS                                                     C4         3
            CHT=.1                                                            C8         1
            TY=YMA+1.2*YS                                                     PLOT2     43
            ENCODE (25,140,TIT(1) )(NTS(IT),IT=1,12)                          PLOT2     45
            CALL PLTSYM(CHT,TIT(1),0.,TX,TY)                                  C2        19
            CALL LABELA (DX,DY,XMI,XMA,YMI,YMA,XFAC,YFAC)                     PLOT2     58
            CALL PLTUND(XMI,XMA,YMI,YMA)                                      C2        20
            CALL PLTDTS(1,0,T(1),P(1),KN,0)                                   C3         8
            CALL PLTPGE                                                       C2        22
            IF (LP.NE.NOS) GO TO 130                                          PLOT2     60
            IF(NOS.EQ.1)GO TO 130                                             HPAD      59
            REWIND 2                                                          PLOT2     67
            IF (JSW.EQ.1) GO TO 100                                           PLOT2     68
            NOS1=NOS                                                          PLOT2     69
            GO TO 110                                                         PLOT2     70
        100 NOS1=NOS-1                                                        PLOT2     71
        110 DO 120 IJ=1,NOS1                                                  PLOT2     72
            IF (JPI(IJ).EQ.0) GO TO 120                                       PLOT2     73
            JIP=JPI(IJ)                                                       PLOT2     74
            READ (2) (T(IU),IU=1,JIP),(P(IU),IU=1,JIP)                        PLOT2     75
        120 CONTINUE                                                          PLOT2     76
        130 RETURN                                                            PLOT2     77
      C                                                                       PLOT2     78
        140 FORMAT(12A2,1HD)                                                  HPAD      60
            END                                                               PLOT2     80
```

```
      C
            SUBROUTINE SKIP                                                    HPAD      61
            SUBROUTINE SKIP                                                    HPAD      62
      C                                                                        HPAD      63
            COMMON R(25000),T(23000),P(23000),NOS,LP,LABEL(4),NY(6),Y(6),IQ(5) HPAD4      1
           1 ,SBL,I,TZ,JP,IX,DELT,IDZ,MOP(10),LLC,B,SA,SB,DTIME,NJ(10),TSTART, HPAD      3
           2 SC, SKP, XAX, XFAC, YFAC, TIT(30), ISU, KP, YB, XB, NTS(24),ITZ,  COM       4
           3 JPI(50),IZ,ITM,NOSR,N,IPNO(5),SS,KSTS1,KSTS2,YAX,JSW,KU           HPAD      4
            DIMENSION PI(1),PI2(1)                                             HPAD      5
            EQUIVALENCE (R(1),PI(1)),(R(12501),PI2(1))                         HPAD      6
            WRITE(6,1)IQ                                                       HPAD      65
          100 CALL DATAIN                                                      HPAD      66
            DO 150 I=1,5                                                       HPAD4     5
            IF(NTS(I).NE.IQ(I))GO TO 100                                       HPAD4     6
          150 CONTINUE                                                         HPAD4     7
          200 WRITE(6,2)                                                       HPAD      70
            RETURN                                                             HPAD      71
            1 FORMAT(' SKIP TO CHANNEL ',3A2)                                  HPAD      72
            2 FORMAT(' END OF CHANNELS TO BE SKIPPED')                         HPAD      73
            END                                                                HPAD      74
```

APPENDIX E.3

Sample Output

LBR47 1 1 4 4588

ID=LBR47 1 1 4
X'S 2886.180 2385.880 2837.500 2909.480 3128.640 3485.460
5.965 5.172 6.207 5.188 5.153 5.829

ORIGINAL EQUATIONS

.10000000E+01 0. 0. 0.
.10000000E+01 .27970000E+03 .78232000E+05 .10000000E+01
.10000000E+01 .55132000E+03 .30395374E+06 .20000000E+01
.10000000E+01 .82330000E+03 .67782289E+06 .30000000E+01
.10000000E+01 .11004600E+04 .18110122E+07 .40000000E+01
.10000000E+01 .13792800E+04 .19024133E+07 .50000000E+01

CHANNEL	GAGE	CALIB CONSTANT	SA	SB	SC	SIG(1)	SIG(2)	SIG(3)
1	1 4	1.0000	-.77917E-02	.36549E-02	-.15010E-07	.99777E-02	.33900E-04	.23671E-07

INDEX TO FIDUCIAL = 1069
BASELINE AVERAGE = 2369.85
TIME AND DATA POINTS SAVED - TIME INTERVAL, MS= .012500

12.5125	-1.02	-1.03	-1.03	-1.02	-1.02	-1.03	-1.04	-1.03	-1.03	-1.02	-1.01	-1.01	-1.00	-1.00	-1.00
12.7000	-1.01	-1.03	-1.05	-1.05	-1.05	-1.02	-1.02	-1.00	-1.00	-1.02	-1.01	-1.02	-1.03	-1.05	-1.04
12.8875	-1.02	-1.02	-1.02	-1.03	-1.02	-1.02	-1.03	-1.03	-1.02	-1.01	-1.01	-1.03	-1.04	-1.04	-1.03
13.0750	-1.02	-1.03	-1.04	-1.05	-1.03	-1.03	-1.03	-1.03	-1.02	-1.00	-1.00	-1.00	-1.02	-1.02	-1.00
13.2625	-1.01	-1.04	-1.05	-1.05	-1.01	-1.01	-1.04	-1.07	-1.07	-1.03	-1.01	-1.01	-1.03	-1.03	-1.00
13.4500	-1.00	-1.02	-1.05	-1.04	-1.01	-1.00	-1.00	-1.02	-1.03	-1.01	-1.02	-1.04	-1.05	-1.04	-.98
13.6375	-.96	-.98	-1.02	-1.04	-1.04	-1.05	-1.04	-1.05	-1.03	-1.01	-1.02	-1.02	-1.04	-1.03	-1.01
13.8250	-1.00	-.99	-1.00	-1.03	-1.03	-1.03	-1.01	-1.01	-1.01	-1.01	-1.02	-1.04	-1.05	-1.04	-1.01
14.0125	-.98	-1.00	-1.04	-1.07	-1.08	-1.05	-1.01	-1.01	-1.00	-1.00	-1.00	-1.01	-1.04	-1.05	-1.04
14.2000	-1.02	-1.00	-1.01	-1.01	-1.01	-1.00	-1.02	-1.05	-1.05	-1.04	-1.02	-1.01	-1.02	-1.01	-1.01
14.3875	-1.02	-1.04	-1.05	-1.04	-1.01	-1.00	-1.00	-1.02	-1.02	-1.02	-1.01	-1.01	-1.02	-1.01	-1.00
14.5750	-1.00	-1.01	-1.02	-1.01	-1.00	-1.01	-1.04	-1.06	-1.05	-1.04	-1.01	-1.02	-1.03	-1.03	-1.02
14.7625	-1.01	-1.02	-1.02	-1.03	-1.02	-1.01	-1.02	-1.02	-1.03	-1.03	-1.02	-1.02	-1.01	-1.02	-1.04
14.9500	-1.07	-1.09	-1.07	-1.05	-1.04	-1.02	-1.02	-1.02	-1.05	-1.09	-1.09	-1.08	-1.04	-1.04	-1.06
15.1375	-1.08	-1.08	-1.05	-1.04	-1.04	-1.05	-1.05	-1.03	-1.04	-1.06	-1.08	-1.09	-1.06	-1.04	-1.03
15.3250	-1.06	-1.07	-1.06	-1.07	-1.07	-1.08	-1.06	-1.05	-1.05	-1.05	-1.06	-1.04	-1.03	-1.04	-1.07
15.5125	-1.09	-1.06	-1.03	-1.02	-1.04	-1.07	-1.08	-1.07	-1.06	-1.05	-1.06	-1.06	-1.04	-1.05	-1.05
15.7000	-1.05	-1.03	-1.02	-1.02	-1.02	-.99	-.90	-.81	-.74	-.70	-.71	-.71	-.69	-.68	-.68
15.8875	-.69	-.69	-.69	-.71	-.72	-.72	-.71	-.68	-.67	-.68	-.69	-.72	-.73	-.72	-.71
16.0750	-.70	-.70	-.69	-.69	-.70	-.71	-.72	-.72	-.69	-.68	-.68	-.69	-.71	-.70	-.69
16.2625	-.69	-.70	-.72	-.72	-.71	-.71	-.71	-.74	-.74	-.73	-.72	-.71	-.72	-.72	-.71
16.4500	-.72	-.71	-.71	-.70	-.69	-.70	-.73	-.74	-.74	-.71	-.71	-.71	-.71	-.72	-.71
16.6375	-.72	-.73	-.72	-.71	-.70	-.69	-.69	-.69	-.70	-.72	-.71	-.71	-.69	-.69	-.71
16.8250	-.72	-.71	-.71	-.71	-.72	-.72	-.71	-.70	-.70	-.71	-.70	-.68	-.68	-.69	-.69
17.0125	-.69	-.68	-.69	-.69	-.68	-.68	-.65	-.68	-.71	-.72	-.71	-.68	-.68	-.70	-.72
17.2000	-.72	-.71	-.68	-.68	-.68	-.69	-.69	-.69	-.69	-.69	-.68	-.69	-.70	-.72	-.74
17.3875	-.73	-.72	-.70	-.71	-.74	-.75	-.73	-.70	-.68	-.71	-.74	-.76	-.76	-.74	-.73
17.5750	-.73	-.72	-.72	-.70	-.70	-.71	-.72	-.72	-.73	-.74	-.75	-.74	-.73	-.72	-.72
17.7625	-.72	-.72	-.72	-.74	-.74	-.74	-.74	-.73	-.74	-.74	-.75	-.75	-.75	-.76	-.76
17.9500	-.76	-.78	-.79	-.79	-.79	-.80	-.82	-.83	-.84	-.84	-.85	-.87	-.88	-.86	-.83
18.1375	-.82	-.83	-.86	-.89	-.89	-.90	-.93	-.97	-1.00	-.99	-.97	-.99	-1.02	-1.04	-1.03
18.3250	-1.02	-1.02	-1.02	-1.02	-1.02	-1.03	-1.06	-1.06	-1.08	-1.04	-1.04	-1.07	-1.08	-1.08	-1.06
18.5125	-1.06	-1.08	-1.11	-1.11	-1.07	-1.06	-1.06	-1.09	-1.08	-1.06	-1.06	-1.09	-1.11	-1.11	-1.09
18.7000	-1.08	-1.08	-1.09	-1.07	-1.06	-1.04	-1.05	-1.07	-1.07	-1.06	-1.06	-1.06	-1.06	-1.05	-1.01
18.8875	-.98	-.97	-.97	-.96	-.93	-.90	-.87	-.87	-.87	-.88	-.89	-.90	-.92	-.93	-.92
19.0750	-.90	-.87	-.85	-.84	-.83	-.85	-.87	-.89	-.88	-.86	-.86	-.87	-.87	-.89	-.89
19.2625	-.90	-.90	-.89	-.88	-.86	-.86	-.88	-.88	-.90	-.91	-.89	-.87	-.87	-.88	-.88
19.4500	-.89	-.87	-.87	-.88	-.89	-.89	-.90	-.90	-.90	-.87	-.84	-.85	-.89	-.92	-.91
19.6375	-.88	-.85	-.83	-.84	-.84	-.83	-.82	-.82	-.82	-.81	-.79	-.80	-.81	-.83	-.88
19.8250	-.79	-.80	-.81	-.82	-.81	-.80	-.82	-.83	-.81	-.79	-.78	-.80	-.82	-.84	-.84
20.0125	-.82	-.80	-.80	-.80	-.79	-.78	-.80	-.84	-.87	-.87	-.83	-.79	-.77	-.76	-.76

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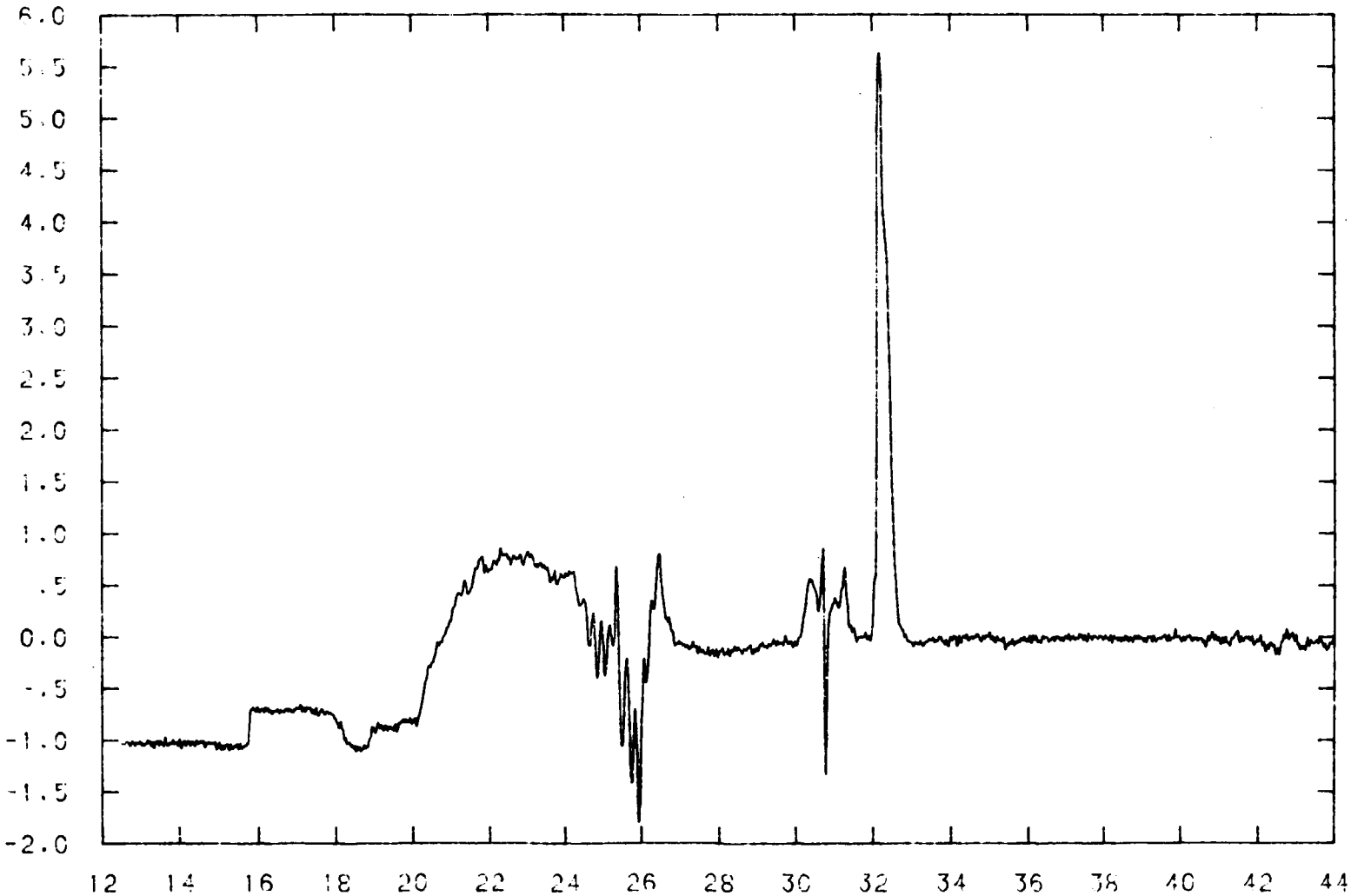
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APPENDIX E.4

Definition of Parameters and Other Control Variables

TABLE E1. INPUT CARD IMAGE

Variable	Format	Column	Description
IPNO(2)	I1	4	Sets IDZ and IX as specified in Table E2.
IDZ			The increment for choosing the input data to be saved (e.g., 5=save every fifth sample.)
IX			The number of samples to skip after the fiducial mark to reach the data which are to be processed.
IPNO(3)	I1	5	Sets KP, MOP(3) and MOP(4) as specified in Table E2.
KP			Plotting option: 0 = no plot, 1 = special plot to be programmed by user, 2 = normal page-size plot.
MOP(3),MOP(4)			Choices for integrating: none, once, or twice.
B	F10.3	6-15	Calibration constant for the gage in engineering units per calibration step.
IXS	I10	16-25	0 = no change to the value set in IPNO(2); 0 ≠ change the value set in IPNO(2) to this value.
DLTM	F10.0	26-35	Time adjustment to be subtracted from the value of TSTART.
IDZS	I5	36-40	0 = no change to the value set in IPNO(2); 0 ≠ change the value set in IPNO(2) to this value.
NLIST	I5	41-45	0 = NAMELIST not used; 1 = NAMELIST used (see Table E3.)
IFID	I5	46-50	0 = fiducial mark is present; 1 = no fiducial mark.
NLK	I5	51-55	Number of contiguous data sets to be processed the same way.

TABLE E2. PARAMETER SETTINGS

Parameter	Value	Description
IPNO(2)*	0	Skip this data set if IPNO(3) = 0 also; otherwise, an error message is printed and processing halts
	1	IDZ = 1 and IX = 500
	2	IDZ = 1 and IX = 2000
	3	IDZ = 1 and IX = 3000
	4	IDZ = 2 and IX = 500
	5	IDZ = 2 and IX = 2000
	6	IDZ = 2 and IX = 3000
	7	IDZ = 5 and IX = 500
	8	IDZ = 5 and IX = 2000
	9	IDZ = 5 and IX = 3000
IPNO(3)**	0	Skip this data set if IPNO(2) = 0 also; otherwise, an error message is printed and processing halts
	1	KP = 0, MOP(3) = 0***, and MOP(4) = 0***
	2	KP = 0, MOP(3) = 2, MOP(4) = 0
	3	KP = 0, MOP(3) = 2, MOP(4) = 2
	4	KP = 1, MOP(3) = 0, MOP(4) = 0
	5	KP = 1, MOP(3) = 2, MOP(4) = 0
	6	KP = 1, MOP(3) = 2, MOP(4) = 2
	7	KP = 2, MOP(3) = 0, MOP(4) = 0
	8	KP = 2, MOP(3) = 2, MOP(4) = 0
	9	KP = 2, MOP(3) = 2, MOP(4) = 2

* If these choices for IDZ and IX are unacceptable, choose the option closest to the desired value and insert the correct values as IDZS and/or IXS on the input card image.

** If IPNO(2) = 0 and IPNO(3) = 0, the array IQ is read in from the next card image with format 5A2. The array IQ must exactly match NAMEF, as defined in the data file created in ADTAPE2, of the next data set to be processed. If IQ and NAMEF do not match, the search will continue to the end-of-file marker.

*** 0 = no; 2 = yes. For one integration MOP(3) = 2 and MOP(4) = 0. For two integrations MOP(3) = 2 and MOP(4) = 2.

TABLE E3. NAMELIST VARIABLES

Variable	Default Value	Description
IBSE	500	Number of samples to skip after the fiducial mark before starting to sample the baseline.
ITM	23000	Maximum number of data samples to be converted to engineering units.
ITZ	950	Number of samples to skip after sampling the last calibration step before starting to search for the fiducial mark.
MOP		Control variable: 0 = end of processing, 1 = conversion to engineering units, 2 = integration, 3 = plotting.
NS	6	Number of calibration steps to be used in the least squares regression.
NX	40	Number of samples to be averaged for each calibration step.
NY	16,100,240, 360,480,600	Sample indices marking the position on each calibration step to start processing data.
SKP	150.	Criterion for eliminating spikes in calibration steps.
SS	1.	Step size of each calibration step, usually, in ohms or volts.
XAX	7.5	Abscissa graph size in inches.
XFAC	1.	Scale factor for the numeric label on the x-axis (e.g., if XFAC = .001 and the number to be printed is 10000, a 10 will be printed.)
YAX	5.	Ordinate graph size in inches.
YFAC	1.	Scale factor for the numeric label on the y-axis, similar to XFAC.

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